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ABSTRACT

This social studies unit suggests activities and teaching methods for use by seventh grade social studies classroom teachers as they develop and implement educational programs on global food, population, and energy problems. Objectives are to help students become aware of global interdependence, identify roles of various nations in causing and solving problems related to food and population, and develop skills in gathering and analyzing data regarding world problems. The document is presented in seven sections. Chapter I suggests activities which introduce students to global interdependence and to differences in life styles between developed and developing nations. Students are involved in a variety of activities including determining items essential to a 'good life', working with maps and globes, creating bulletin boards and collages, answering questions on worksheets, and discussing global issues in small groups and in class. Chapters II through IV present activities which focus specifically on population, food, or energy. Activities involve case studies, data sheets, time lines, simple computation problems, and map and globe work. Chapters V and VI offer culmination activities and supplemental projects. Students are directed to pull together background information and skills gained through participation in earlier course activities. Specific activities and projects in which they are involved include producing a filmstrip, making posters and bulletin boards, creating energy tools out of 'classroom junk', discussing food and energy sources, and diagramming energy issues. For all activities suggested in the document, information is presented on title, background, objectives, time and materials required, skills, focus, and procedures. (DB)

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Barbara Miller, Editor

THINKING GLOBALLY, ACTING LOCALLY ABOUT FOOD, POPULATION AND ENERGY ISSUES

SP 013 150

Seventh Grade Interdisciplinary Unit
Compiled Under A Grant With
The Center For Teaching International Relations

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MAR 1 1981

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GLOBAL EDUCATION SPEAKERS

1. Foreign Student Center
   University of Colorado
   Boulder, Colorado 80309 — 492-8057

2. International Student Center
   University of Denver
   Denver, Colorado 80208 — 753-2462

3. ELS Language Center
   Loretto Heights College
   3001 S. Federal Blvd.
   Denver, Colorado 80236 — 922-8311

4. The Bridge International School
   1800 Pontiac
   Denver, Colorado 80220 — 320-1217

5. Also, you may wish to look in the Mountain Bell yellow pages under the heading "Consulates" for accredited representatives of foreign governments located in Denver.

All organizations should be contacted as far in advance of the date you want a speaker as possible. Results will be enhanced if you are very specific as to the level of students who will hear the speaker, what they have already studied about the country or region, and what--in specifics--you would like a speaker to talk about with students.

FOOD AND POPULATION GOALS
Revised November 14, 1979

During the year long study of world cultures, teachers will:

1. Create an awareness of various problems faced by people of the world.

2. Provide an opportunity for students to integrate the study of world cultures and problems of food and population and energy throughout the year.

3. Provide students with the opportunity to find relationships among global issues through the various disciplines that they study.

Student Objectives

1. Students will construct a global overview of the causes of food, population, and energy problems and pose possible solutions.

2. Students will identify the role that nations have played in causing and solving problems related to food and population with their technology and resources.

3. Students will identify similarities and differences among the cultural attitudes of the western and non-western world regarding food, population and energy.

4. Students will use interdisciplinary skills (i.e., problem solving, decision making, discussion, public speaking, parlimentary procedure, organizing, graphing, analyzing and interpreting data and collecting information from multiple sources).

5. Students will participate in solving global problems by taking an action step to change their lifestyle and community.

jc11/209

THE FOOD AND POPULATION CONFERENCE OBJECTIVES

The primary goal of the Food, Population and Energy Conference is to provide a forum for seventh grade social studies students to discuss problems and solutions related to food and population.

Through participation students will:

1. Apply skills and knowledge about food, population and energy gained in the classroom in a broader setting (i.e., scouts, church groups, the home and neighborhood).

2. Stimulate an increased awareness in both school and community about global problems related to food, population and energy.

3. Demonstrate communication skills through the preparation and presentation of resolutions about food, population and energy.

4. Gain confidence in individual abilities through interaction with students from other schools as well as adults.

jc11/209

Introductory Activities

Students list what are essential material needs for the "good life."

Title: THE GOOD LIFE (Pre-Post Attitude Test)

Introduction:

This is a values clarification activity which asks students to think about what they consider to be necessary for them to lead the "good life." In thinking about desired life styles, students can sort out their deepseated feelings toward material wealth.

Objective:

To determine which items from a selected list are "necessary" and which are "not necessary" to lead a comfortable life style.

Grade Level: 2-12

Time: One hour

Materials: Handout, "Items for the Good Life"

Procedure:

Step 1. Distribute one copy of the handout to each student. Ask students to fill out the handout individually.

Step 2. Divide into groups and have each group come up with a list of items "necessary" for the good life. Check those items your group would be willing to give up.

Debriefing:

1. Can students find good reasons to need these items?
2. Which items are most commonly listed as essential to living the "good life"?
3. How many of the items on the list are sold by ads which promote the "good life"?
4. Why are students willing to give up certain items? How do they feel about giving up certain items?
5. Did the "have" column come close to matching the "good life" column? Can students explain the difference?
6. Can students account for differences of opinion on the "good life"?
7. Do students think that people in other cultures would agree with the class's list of essentials for the "good life"?
8. Which items are associated with food; which with energy resources?
9. How much would your class's list contribute to the depletion of natural resources?

Adapted from an activity by Gary Smith

Extended Activities

1. Obtain a collection of expendable old magazines and catalogs. Cut out pictures of items on the list of essentials and post around the room. If students must limit the list of essentials to ten, which ones would they choose?

2. Hang lists of "necessary" for the good life around the room. After finishing this unit return to the lists and reevaluate. Would you make any changes on the original lists? Why?

ITEMS FOR THE

"GOOD LIFE"

Name of Items	Which do you have?	Which do you think are necessary for you to live the "good Life"?	Which items you have would you be willing to give up?

Title: HOW THINGS CONNECT

Introduction: A graphic way of illustrating the degree of interdependence among problems is to have students locate points of origin for current news items on a world map, and then locate other places on the map where those same news items will have economic, political, and social consequences. By drawing lines between the various points, students should be able to recognize the extent of interdependence between overpopulation, food and energy issues and their problems.

Objectives:

To recognize the extent to which news items related to overpopulation, food and energy, many of which appear strictly local or national in scope at first sight, have global implications and consequences.

To brainstorm ways in which overpopulation, food and energy issues are related on a global basis.

Grade Level: 7-12

Time: 45 minutes

Materials: Large wall map of the world.

Basic Skills Focus:

A. Map reading (interpretation)

B. Building and using concepts (interdependence)

Procedure:

(Teacher preparation: Tape up wall map)

Step 1. Divide class into groups of five to six students per group.

Step 2. Give each group four to five newspapers.

Step 3. Ask students to cut out all the news articles they can find related to overpopulation, food and energy. Allow about 10 minutes for this step.

Step 4. Ask one member of each group to collect all the clipped articles. Ask those same students to bring the clippings to the wall map.

Gary R. Smith's activity from Teaching About Energy Awareness, Center for Teaching International Relations

Step 5. Have those same students place a dot or mark on the map indicating where the news article originated. For example, if the article is about a blackout in New York City, the students should place the dot on New York City. If the article is about an agreement made in Tunis among the OPEC nations regarding selling oil to the United States, place the dot in Tunis. (Note: Encourage help from each student's group with locating the origin of the articles. Reassure students that this is not a test of how well they know geography. This step should be carried out with help from the whole class including your input.)

Step 6. Ask another member of the same groups to come to the map. As a class, students need to brainstorm the following: Where else in the world would the news item have an effect? As these places are stated, the student at the map should place a dot on the location. The places could be cities, countries, regions, or geographical areas.

Step 7. Ask another person from the groups to come up to the map. This student's job is to draw lines connecting dots for each news article using a yardstick. For example, if the news item is about development of a number of power plants in South Africa and students have decided that the item could have consequences in the United States and the USSR, then the student should draw a line connecting the dots between South Africa and the United States and a second line connecting the dots between South Africa and the USSR.

Step 8. Proceed to follow the same procedure as outlined in steps 4-7 above for the remainder of the groups in the class, or until you and your students get tired of the activity.

Debriefing:

1. This activity usually ends with a map full of lines. Hence, it graphically illustrates the interdependence of these issues. Ask students if the map became cluttered with lines and what they may mean.

2. What things about how these issues and problems are interconnected did students learn from this activity? (Possible responses: overpopulation, food and energy news items have geographical implications far beyond their points of origin; there is a much greater degree of interrelatedness between places and events than people ordinarily realize; decisions in one part of the world are dependent upon and have impact on peoples and resources in other parts of the world; items ordinarily considered as local or national in scope often have international dimensions.)

Title: Find a Million* (by George Otero)

Introduction: For many people, a million is a number with a vague meaning. It is often difficult to get a handle mentally on the meaning of having a million of something. This activity gives participants the chance to explore the notion of a "million" in numerous contexts taken from their own environment. This may not help in understanding what a million is, but it should broaden the participants' knowledge of concepts such as a million miles, a million dollars, or a million people. In addition, participants are encouraged to brainstorm, invent, and explore, utilizing important thinking skills.

Lesson Objectives:

-----to involve participants in recognizing, documenting, and proving the existence of a million of something.

-----to familiarize participants with the concept of a million by utilizing the participants' own environment.

Mechanics:

Time: 1 class period

Materials: none needed for this activity.

Activity:

1. Tell the group to go outside and find a million of something. After they have done this, tell them to prove they have a million.
2. Participants will not respond immediately because the task seems so difficult. Give them time to think and encourage them, yet don't give answers. Once the group determines or discusses a few examples, the list will appear never-ending.
3. Make a list of all the items found; of all the items proven. Discuss these questions with the group:

a. Did this exercise make a million any more understandable?

b. Does a million seem to be a bigger or smaller number than it appeared to be before completing the activity? Does it appear to be the same?

Further Suggestions:

Find a million of something and bring it to class or a group meeting.

What differend kinds of items can you think of such that a million of the item would fit into a 3-ft. cube box?

* Adapted from an activity in the Environmental Studies Cards

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ACTIVITY 1: WHAT'S A MILLION?

Before beginning this activity, tell students to bring to class as many advertisements and newspaper articles as they can find that use large numbers. Some students may bring a list of advertising slogans that use large numbers that they have seen in their community. (i.e. McDonalds: "Over 6 Billion Sold").

Materials:

Student collected advertisements and newspaper articles
Classroom bulletin board

Time Allotment: 1 class period; also an on-going activity throughout the unit

Procedure:

1. Ask students to bring in ads and articles mentioning numbers in the thousands, millions and billions.

2. Examine the ads and articles. Encourage students to develop their own categories for their collection. Students might choose to categorize their data according to advertisements of different companies or organizations. They might also develop groups based on the numbers represented: millions, billions and thousands. Some categories may be formed according to how the number is used. Is it used with dollars, barrels of oil, weapons or people?

3. Post the collection of advertisements and articles around the room. Mention to students that this activity is on-going. They will be able to add to their collection as they encounter more advertisements and articles that make use of large numbers.

4. Ask students to now consider how the large numbers are used. Do the numbers represent actual numbers or are they exaggerations? How can they tell? Do students think these numbers were used as frequently in the past? Why or why not?

ACTIVITY 3: NOW, WHAT'S A BILLION?

The "leap" from a million to a billion is not just a hop, skip and a jump. You can tell just about anyone that a billion is 1,000 million, but visualizing or "feeling" a billion is another, much more difficult task. Among other things, in this activity students discover that a billion can be 250,000 pages with 4,000 dots on each page. And if the pages are piled the height of a 33 story building, the present world population is represented by dots—not monsters!

Materials:

Student worksheets (2)
"Dots" and "Now, What's a Billion?"

Time Allotment: 1 class period

Procedure:

1. Duplicate and distribute each handout to students. Students answer questions on worksheet (explanation provided). This part of the activity should take about 20 minutes.

2. Debriefing ideas:

   Go outside with the dot worksheets and walk around the football field to get an idea of global population. What does a "first down" represent?

   Find out what building in the community is 33 stories tall. Is there a building that tall in students' community?

   Find out how many hamburgers have been sold at the local McDonalds. How do they keep count?

   Allow students to verbalize their ideas about large numbers. Can they compare the "million" identified in the previous activity with the "billion" discovered in this activity?

Extended Activities:

1. Duplicate 250 dot handouts to place around the room, in the school corridors, the cafeteria, etc. How many dots are represented by 250 pages? (1,000,000)

2. Class could conduct a school contest to guess the number of dots. Do most people understand a "million?" A "billion."

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developed for the Project for an Energy Enriched Curriculum, NSTA, 1978.
Authors: Jacquelyn Johnson and Gary Smith.

Teacher Explanation: NOW, WHAT'S A BILLION?

1. 50 (down) x 80 (across) = 4,000 dots
2. 1,000,000 dots ÷ 4,000 dots per page = 250 pages
3. add 3 0's to 250 or 1,000,000,000 ÷ 4,000 = 250,000 pages
4. (see question 2) 1" = 250 pages = 1,000,000 dots
5. 1" = 1 million, so for 1 billion, add 3 0's; 1,000 " or 83 1/3 feet, or 28 yards
6. (see question 3) 250,000 x 4 = 1,000,000 pages
7. (see question 5) 1,000" x 4 = 4,000 inches, almost 334 feet (longer than a football field, taller than a 33 story building.

"Daddy, does 'zillion' come after 'trillion'?"

NOW WHAT'S A BILLION?

1. How many dots are on your handout?

2. How many pages would it take to make one million (1,000,000) dots?

3. How many pages would it take to make one billion (1,000,000) dots?

4. If in each inch there are 250 pages, how many inches of paper would it take to make a total of one million dots?

5. How many inches would it take to make a total of one billion dots?

6. There are approximately four billion people in the world. If each dot represented one person, how many pages would be necessary to show the population of the world?

7. How many inches of paper would represent the population of the world with the dots?

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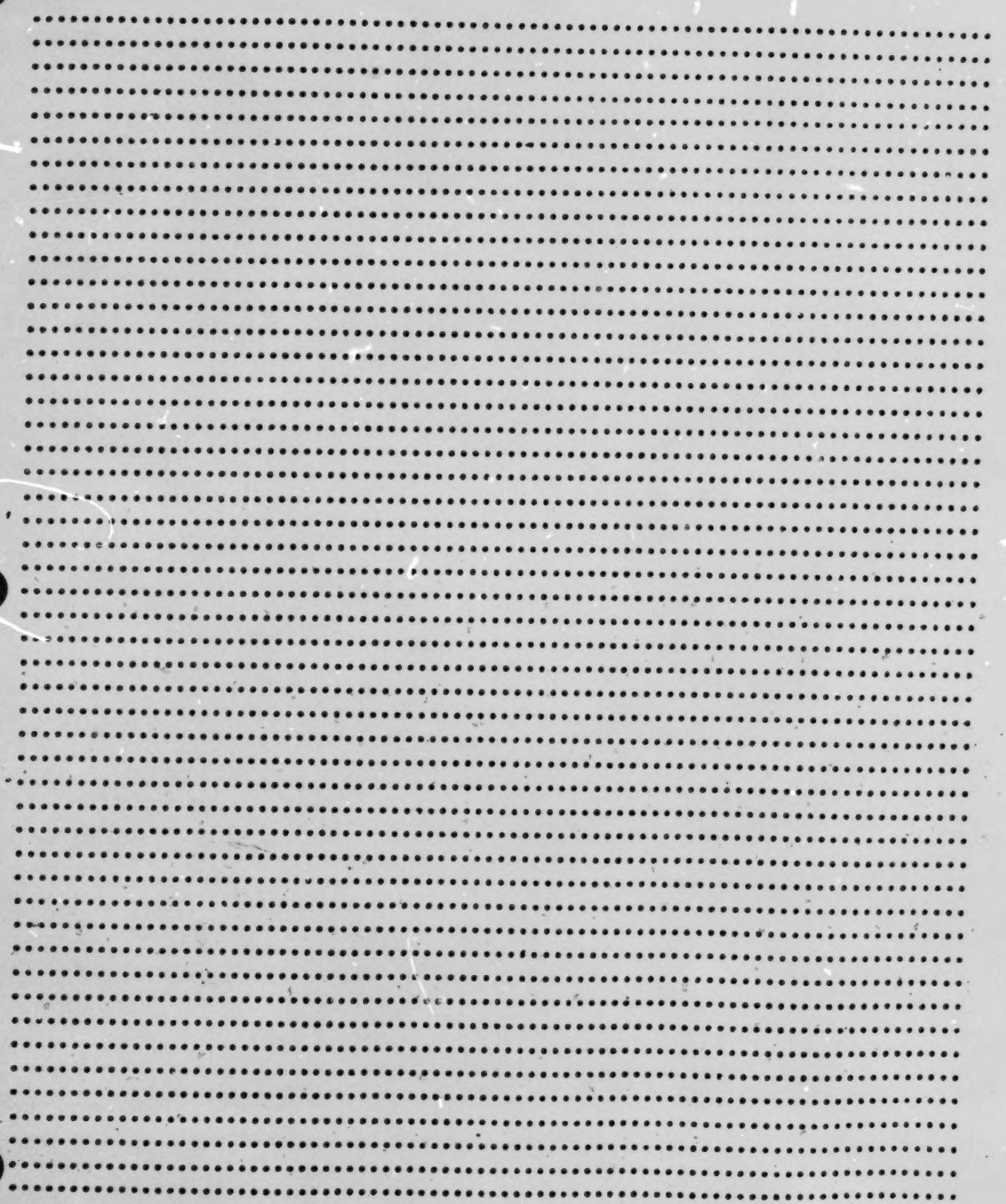
DOTS



SPEND A MILLION

Introduction:

One way of providing students with an understanding of what a million is, is to have them spend $1 million. The student can look at what a million can buy in different contexts.

Lesson Objectives:

1. To apply the concept of spending $1 million to the student's personal needs and wants.

2. To compare spending $1 million on personal items with spending $1 million as foreign aid to solve food and population problems.

Procedures:

1. Tell the group to look through magazines and select pictures to put in a notebook of things they would like to buy. The price should be placed by each item. Students should spend money until they have reached the total of $1 million. The teacher will have to set some limits (no Lear jets) as to what goes into the book.

2. Debriefing questions:

   a. What type of items have you purchased?

   b. Who has the highest number of items? The lowest number?

   c. What conclusions can you make about the types of things that you have purchased? What conclusions can you make about how much $1 million will buy?

3. Ask questions which allow them to look at the concept of foreign aid.

   a. What could the leaders of India (or some other developing nation) do if our class could transfer our hypothetical millions to them for solving their food and population problems?

   b. Role play a group of people in India trying to spend $30 million to help their people. The class may wish to compile a notebook following a discussion to illustrate how much could be purchased with $1 million to solve problems related to food and population.

Ed Burleson
East Middle School
jc12/109

Title: If You Can't Count It, Does It Exist? (Adapted from an activity in the Environmental Studies Cards) by George Otero

Introduction: This is a very simple, open-ended activity designed to help participants focus on measurement as it relates to the concept of counting. The activity can involve a single individual or an entire class or group.

Lesson Objectives:

-----to give participants the opportunity to explore ways of counting things they never thought could be counted.

-----to introduce participants to a variety of ways to count things.

Mechanics:

Time: 1 class period

Materials: none needed for this activity

Activity:

1. Give the group the following task: Make a list of things that appear to be impossible to count...then count any three. Give the group time to think about and explore the task. Encourage participants, get involved yourself, but refrain from giving any answers. Allow the participants to discover what they can.

2. Possible follow-up activities and discussion questions:

a. Do the numbers of something that is impossible to count change from time to time?
b. What makes something impossible to count?
c. How does it become possible to count it?

Examples: Rice, Grain

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THE WORLD AND 37.4 CANDY BARS

by Les Stanwood

Overpopulation, Starvation, Deprivation. How can affluent American students ever come to understand these terms? How can we help them to appreciate the disparity between the amounts that Americans consume, and that consumed by the Third World countries? Indeed, how can we even show them how densely populated Europe is?

For years I struggled with these questions. I showed pictures from India, described experiences in Europe, used all the "gee-whiz" statistics I could muster. Still, I never felt they really understood.

Now, I think I have a way to help them at least *begin* to understand. It's a simulation put together by myself and several senior students. It can be conducted in any classroom, and with only a minimum of preparation. The results are always striking.

Before the students come into the class, I divide the room into segments that represent the major land areas of the world. Discounting some large areas with little population (Greenland and Australia, for example), the world's land mass comes to about just under 48 million square miles, easily represented by a rectangle that is 24 units by 20 units. (Classrooms with square tiles are particularly easy to set up, requiring nothing more than a place to put the desks and a role of masking tape.) The exact area I give each "continent" is shown on the accompanying chart, which uses political divisions rather than geographic ones since I find these to be more valuable and impressive.

Simulation of current population requires 40 students. As they enter the classroom, I have them draw a card on which is printed the name of a land area. They go to the portion of the classroom so labeled and wait for class to begin. Naturally, most students draw "Asia" cards—there are 24 among the 40 cards—while only a few are fortunate enough to be sent to the more spacious areas.

After the world has been populated and the students are either comfortably established (the case with North America and Africa) or nervously trying to avoid their classmates (as in Asia or Europe), I begin a discussion of the statistics. During this time, students are required to stay strictly within their boundaries; chairs may be given out, especially to the students in North America or to a few in Asia, since this intensifies the sense of inequality.

Once the statistics have been fully explored, I unveil the world's resources: 37.4 candy bars neatly displayed on a large tray. These represent the 1975 Gross World Product of $3,740,000,000,000. (I make it clear that the candy does not represent food alone.) Then I hand out the candy bars to the people in each land area, according to its GNP (see chart). Of course, the two representatives of North America are treated to a feast, while the students in Third World countries argue over the meager supplies.

There are usually two sets of reactions to the distribution of the candy bars. At first, indignation is rampant —the North Americans and Europeans are treated to 25 bars, while the Asians must struggle over how to share five. Students often accuse me of cheating them. Those ensconced in North America are threatened, so much so that they quickly promise to share their allotment after class—a charity which I strictly forbid.

In about ten minutes, the second reaction sets in. The students are stricken by a collective wonder at how this situation is allowed to persist. "Why don't the Asians just take some more candy bars?" they insist. "Why don't the Europeans expand into Africa or South America if they're so crowded?" Why not, indeed?

A variation on this simulation is to use it in terms of the world conditions in the year 2000. This requires 25 more students and a total of 69 candy bars (see the chart for a breakdown of these figures). But the same disparities exist, and this is not lost on the students, many of whom are now packed even more tightly into their respective land areas. Another possibility—one that is particularly relevant in terms of the current energy crisis—is to have 22.2 candy bars represent the proportionate amount of petroleum products consumed in each of the "continents" (these figures are also given with the chart).

However it is used, this approach to world conditions packs more punch than any other approach I have come across. Students leave it with a strong sense of how interrelated all of us are, and some idea of what must be done if our planet is to survive—a valuable lesson in this age of global responsibility. □

Les Stanwood, currently a free lance writer, taught for five years at Mayo High School, Rochester, N.Y.

LAND AREAS	Square Miles	Population		Gross Nat'l Product		1977 Petroleum Prod Consumption
		1975	2000	1975	2000	
Asia	10.6	24	39	5.0	10.0	3.7
Africa & Mideast	11.6	3	8	1.0	1.5	1.1
Soviet Countries	8.6	3	4	5.0	12.0	3.6
South America	7.5	3	6	1.4	3.5	0.9
Europe	1.9	5	5	14.0	22.0	5.0
North America	7.6	2	3	11.0	20.0	7.9
TOTALS	47.8	40	65	37.4	69.0	22.2

Some Notes on the Statistics

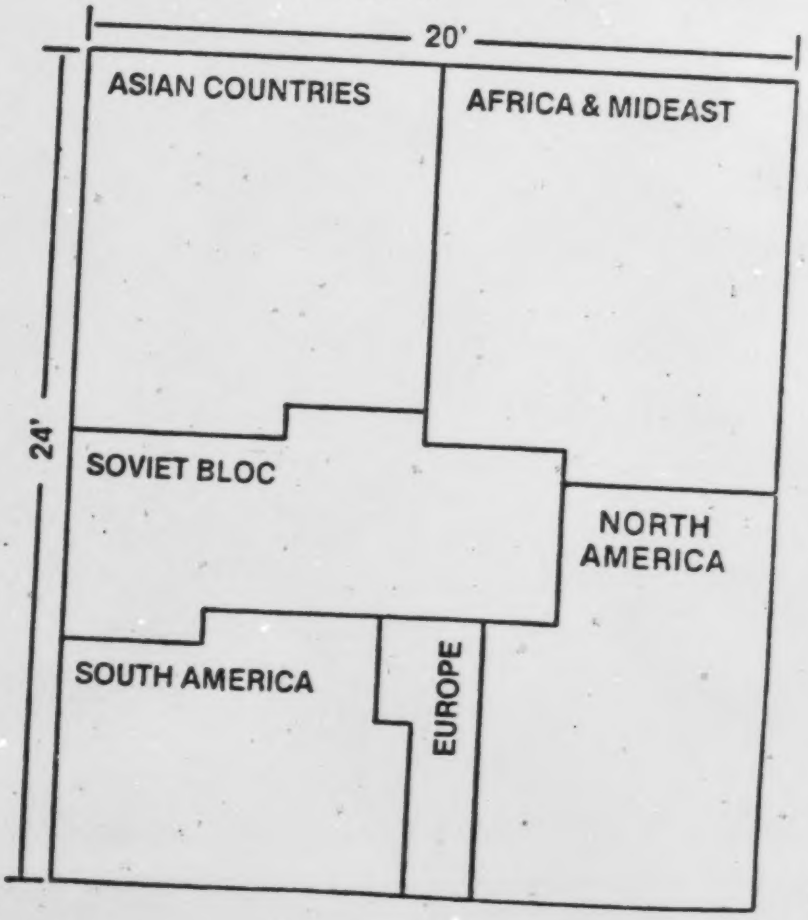
—The land areas for each "continent" do not take into consideration such factors as usability or habitability. Students might research, as a follow-up project, just how these influence the GNP or population of their area.

—Population estimates are based on continued growth at current rates, with adjustments for known variables. Such things as war, widespread famine and disease, or other catastrophic changes are not taken into consideration. Nor are some recent predictions which suggest that world population is slowing down. Students might be asked to evaluate the accuracy of the model, and to analyze the factors which may come into play as the world approaches the year 2000.

—Gross National Products have been used as the index of consumption for each area because they are the only figures which are easily accessible. For the communist countries, only approximations are available. The relationship of another nation's GNP to our own may be tenuous enough to result in other inaccuracies. GNP figures for the year 2000 are probably the least accurate of all the statistics, since economic forecasting can only vaguely indicate what the world will be like in the decades ahead.

—Consumption of petroleum products reflects 1977 statistics. As with the GNP, the figures for the Communist countries (especially China) are based on estimates.

CLASSROOM DESIGN



Title: Hide and Seek -- Where is Everybody? (by George Otero)*

Introduction: If students are talking about the world's population, they should know where, geographically speaking, the people are. They are not spread evenly around the earth's surface, and the density and distribution of human beings are important factors to consider when analyzing problems related to population growth. This activity has students make some guesses about population distribution and then has them check those assumptions, using an atlas and attending map skills.

Lesson Objectives:

Students complete the sequential worksheet on population distribution.

Students generalize about the factors which determine where people live.

Students become familiar with the uses of an atlas.

Students gain knowledge about where people are found on the face of the earth.

Mechanics:

Time: 1 class period

Materials: Duplicate copies of the student handout entitled "Introduction to World Population Distribution." Have in addition a classroom or textbook atlas available for students' use.

Activity:

1. Ask the students the question, "Why do people seem to cluster in some places and not in others?" Write down these guesses on the board.

2. Hand out the worksheet for students to complete.

3. Have students read some of their summary paragraphs. Did most of the class write similar statements?

4. Having discovered where people cluster and some of the reasons for these patterns, have students consider this question: "Since people cluster in some areas and not in others what are the implications for food supplies and distribution?" Answers to this question can be listed on the board and used as a basis for individual research.

Source: Berry Beyer.

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INTRODUCTION TO WORLD POPULATION DISTRIBUTION

Study Guide

1. The population of the world is distributed unevenly over the land area. In some places large numbers of people live close together. In other places a few people are scattered over a wide area. In which of the following nations do the people live closest together? (This nation has the most dense population.)

China

England

Mexico

Russia

2. In which of the following nations do the people live farthest apart? (This nation has the sparsest population.)

United States

France

Brazil

Nigeria

3. What is ONE reason you think people congregate in certain places of the world, and not in other places?

4. If this is true, in what kind of places in the world would you expect to find people congregated in large numbers?

5. Examine an atlas and answer the following:

   a) List the places where there are large groups of people that are where you expected to find them according to your answer to question #4:

   b) List any places where large groups of people ought to be according to your answer to #4, but are not there:

   c) What reasons help explain this?

6. a) List the places where there are large groups of people that are not where your answer to Question #4 says they should be:

b) What reasons help explain this?

7. How well does your answer to Question #3 explain the pattern of population distribution in the world?

8. IF YOUR ANSWER TO QUESTION #3 PROVIDES A COMPLETE EXPLANATION, GO DIRECTLY TO QUESTION #10.

9. IF YOUR ANSWER TO QUESTION #3 DOES NOT COMPLETELY EXPLAIN THE WAY PEOPLE ARE DISTRIBUTED THROUGHOUT THE WORLD, LIST BELOW SOME OTHER REASONS THAT MIGHT HELP EXPLAIN THIS (CHECK YOU ANSWERS TO QUESTIONS #5c AND #6b):

10. Write a sentence that best explains why the population of the world is distributed the way it is. Be prepared to explain your reasons for this statement in our next class.

Population

Title: World Population (Film, 3 minutes, color) Available from CTIR: A.P.S.
Center for Teaching International Relations
Graduate School of International Studies
University of Denver
Denver, Colorado 80210
(303) 753-3106

Introduction: To understand the dynamics of population growth, it is helpful for the learner to develop a sense of the geometric patterns of this growth, which can be achieved through working with mathematical equations showing how such results are achieved or by creating a visual picture of that growth in a time/space relationship. World Population does the latter in a dramatic manner by demonstrating the growth of population on a world map from 0 A.D. to 2000 A.D. in about two minutes, to the background of a heartbeat. This provides a basis for examining where population is now as well as the impact of historic population controls.

The focus of this film is on the concept of interdependence. As the group watches the growth of population, they can see how the interdependence of various societies have influenced population growth, providing a springboard for a discussion of the interdependent factors of population as they bear upon the future.

Lesson Objectives:
After completing this activity, each individual should be able to:
1. Suggest several ways population has been controlled in the past.
2. Suggest several ways these population controls were interdependent in nature.
3. Suggest how some of these controls will continue to be operable (or will no longer work) in the future.
4. Draw general conclusions about why population issues are more critical today than in the past.

Mechanics:

Teaching time: 50 minutes
Materials: Film--World Population

Activity:

1. Introduce the film briefly, explaining only that the film gives an overview of population growth in the world. This film may be shown as many as three times during the session. The impact of the first showing is usually sufficient to start the discussion. It is more effective to begin the discussion at this point with the "gut" reactions of the audience. The historic points are better left until the group has a chance to register their reactions to the film.
Show the film. 5 minutes

2. The initial discussion should begin at the "feeling" level, using such questions as:
a. What did you feel as the white dots swept the globe?
b. How would you describe the last 50 years of the film?
c. Does this film provoke any action on your part.

Many feelings will not emerge immediately and the leader should not expect the reactions to be overwhelming. However, a half-dozen sharp comments or feelings will set the tone for the rest of the discussion.
5 minutes

3. Once the tone has been set, the group should move on to more substantive questions to get at why the film took the turn it did. This may be easier to do by starting from the negative side, examining events which controlled population in the past. Suggested questions:

a. Did anyone see any dramatic reduction in dots during the film? When and Where? (Central America about the time of the Spanish conquests; Western Europe during the time of the Black Plague; Western Africa with the decline of the Nigerian empire; periods of major wars)
b. What caused each of these declines? (disease, war, famine, possibly migration patterns will show a slow down or stationary pattern in an otherwise growing area)
c. What were major growth patterns and why? (historically, central river valleys; urban centers beginning with industrialization; migration during colonial eras, especially in the Americas)

At this point, the leader may suggest the film be shown again to point out and clarify some of these events to those who missed them the first time. At the same time, ask the group to concentrate on why the rate of growth seems to increase. Show the film.

20 minutes

4. This final phase of discussion should focus on geometric growth patterns. Suggested discussion starters:

a. Does the overall growth tempo steadily increase, or does it go by spurts and stops?
b. Do some of the factors previously identified as causes for declining growth have less impact today? (disease particularly)
c. Does control of diseases have a double impact on population growth? This is an important question for the discussion and time should be spent either drawing out the answers or explaining the dual impact. (First, devastating plagues are almost non-existent today. Second, medicine has greatly reduced infant and childhood fatalities and this results in greater percentages of the population reaching childbearing ages--hence greater growth, even if family sizes remain stable or decrease.)

15 minutes

5. Conclusion on the discussion should be formulated by the leader and include:

a. Population problems have always been interdependent in nature, i.e. witness the spread of disease and the use of colonization or other migration patterns to reduce population pressures along with the resulting impact on new areas.
b. Population used to be controlled largely through war, famine, and disease.
c. Population in just sheer numbers will inevitably grow faster and faster because of the increasing numbers bearing children--it's a spiraling circle.

5 minutes

Future Resources and Suggestions: Two activities that will be especially useful following this one are an activity to teach the group how to calculate growth patterns and activities using the world population data sheet.

Title: TOO MANY PEOPLE?*

Introduction: The number of people sharing a situation will affect the quality of the experience. Sometimes a lot of people make an event worthwhile; sometimes an activity that is enjoyable with a few people becomes less enjoyable when more people are involved. This activity points out two aspects of population size. First, the question of when there are too many people depends upon cultural views and the situation being considered. Second, the activity points out how all persons are affected by the size of population.

Objectives:

To make decisions about situations using the criterion of "too many people."

To describe situations that students like to be involved in, and describe similar situations which may involve too many people.

Time: One 50-minute class period

Materials: You will need a carrousel projector and slides. You can make your own slides or use pictures. Follow the Suggested Slide Descriptions. This is easily done.

Procedure:

1. Have students list on a sheet of paper ten things they really like to do. Have them put these lists aside.

2. Show the slides, asking students to raise their hands if the situation shown has too many people in it.

   The students will not be sure what you mean. When would there be too many people? That is the question you want them to deal with in the activity. As students respond, have some of them give their reasons for thinking there are too many people in the particular situation (crowding, pollution, poverty, lack of space, less fun, etc.). List these on the board. Check with the class to see if other students agree or disagree about the rating students are giving the situations.

3. Discuss these questions after viewing the slides once:
   a. On what basis did students rate the slides the way they did?
   b. Were students' judgments based on the number of people alone, or did they also consider the environment, context, and culture?
   c. Which slides did most students agree upon? Why?
   d. Which slides did most students disagree on? Why?

4. Now have the students take the list of ten preferred activities they wrote at the beginning of the period and have them describe in writing when these situations would have too many people involved.

*Developed by George G. Otero Jr.

5. Have students share some of these situations. Have these situations ever had too many people? Is there a chance too many people will be doing this activity in the near future?

Further Suggestion:

Have students find their own pictures of situations with too many people. Post on a bulletin board titled "Too Many People." You might also have students write a short story about a situation they were in that had too many people.

SUGGESTED SLIDE DESCRIPTIONS

1. Traffic jam in Los Angeles.
2. Map of the Peoples' Republic of China.
3. Street scene in downtown Manhattan.
4. Housing in Calcutta, India - one entire family shares each brick-walled room.
5. Fans at a U.S. football game.
6. Soviet determination to keep down pollution on the Volga River makes swimming possible even beneath the smoking towers of this steel mill.
7. Recent rock-festival headline.
8. Sahara desert.
9. Junior high kids riding bikes in a group.
10. Part of Chief Lungu's 36 wives and 25 children--proclaims his wealth as head of a clan in Upper Zaire.
11. Session of the U.S. Congress.
12. Photo of map of the Denver Metro Area.
13. Mountain lake scene in America.
14. Boy in front of makeshift house in Sao Paulo, Brazil.
15. A gazetteer of place names at Watson Lake in the Yukon.
16. Some of the millions of peasant workers who have worked on projects on the Huai River, China.
17. Auto, airplane, and industrial pollution scene--United States.
18. A person sleeping in the streets of Calcutta. The weather there is humid, often 100 degrees.
19. Suburb--U.S.
20. Rhodesian blacks and whites--represents proportion of blacks to whites in a country where whites rule as a minority.
21. A flotilla of pleasure craft enters the locks of Kentucky Dam, the first upward step in the Tennessee's 650-mile navigation channel.
22. Black kids on a street in a neighborhood of New Haven, Connecticut.
23. New York City from the air.
24. Picture of the Watson family--American T.V.
25. U.S. unemployment lines in the 1930s.
26. Here at the largest square in India, a million people disperse after a rally for Prime Ministers Gandhi and Sheik Mugibur Rahman, February, 1972--India.
27. Shot of the earth from space.

Title: CROWDING*

Introduction: Crowding may cause and/or accentuate many psychological and social problems. Crowding is considered to be a negative effect of rapid population growth. In this activity, students identify and cut out pictures or draw situations that demonstrate the concept of crowding and/or its effects. Then, students discuss to what degree the effects of crowding which they portray are due to population growth and to what degree the effects are due to social organization, planning, etc.

Objectives:

To identify a picture or make a drawing that reflects student ideas about crowding and its effects.

To infer the causes of crowding using the pictures and drawings that students have collected.

Time: One class period, plus time out of class to collect pictures or complete drawings.

Materials: If you provide magazines and newspapers for students to use, have them ready with scissors and construction paper.

NOTE TO TEACHERS: Refer to the teacher insert on the effects of crowding which is included with this activity before actually beginning the activity procedure.

Procedure:

1. Have students collect or draw pictures showing crowding and/or its effects. This picture can portray any area of the world. The more time that students are given to find or draw a picture, the better the pictures should be. This may mean that the teacher could allow up to 3 or 4 days to collect or draw the pictures.

2. Have the pictures mounted on a background of some kind. Construction paper should serve adequately for this purpose. When this is completed, ask the students to do any or all of the following activities:
   a. Have each student meet with at least one other student on the basis of some similarity in their pictures. They can form groups larger than two, but each student must be in a group. List the categories students found as pairs or groups on the board. See if the group can do the task again without using any of the categories listed. They probably can. List these new categories, and use them with the questions in Step 3.
   b. Have each student write a paragraph stating how his or her picture shows crowding and/or its effects.

*Developed by George G. Otero Jr.

c. Have students exchange pictures while keeping their paragraphs. Ask them to write a paragraph describing how the picture they have received in the exchange demonstrates crowding and/or its effects, without talking to the person who originally selected or drew the picture. The student may feel the picture does not demonstrate the idea of crowding, and should state so in the paragraph if that is the case.

d. Have students work in pairs, comparing what they wrote about the pictures they received with the persons who first selected them. Did they see similar things in the pictures? If so, what were the visual clues? If the other person didn't see an example of crowding and its effects, why did the original selector of the picture find such an example of crowding? Maybe one of the two students will change their mind.

e. Have students write a story about the feelings or activities of a person in the situation and setting portrayed in the picture. This could be done with their own or someone else's picture.

3. Discuss these questions with the class:
   a. Which of the effects of crowding that have been listed or discussed are due primarily to population growth itself?
   b. Which of the effects of crowding that have been listed or discussed are due primarily to social or economic or political factors such as laws, jobs available, prejudices, opportunities?
   c. Which of the effects of crowding will become worse if the population continues to grow rapidly? (All of them.)
   d. Which of the problems associated with crowding can and should be solved? Take one and write out or propose some solutions.

The Effects of Crowding (Teacher Notes)

The conclusions to be drawn from physiology are clear enough. Large segments of the human population may be suffering from the "stress response" syndrome without necessarily being aware of high levels of psychological stress at any one time. This has many ramifications which are in need of research. One practical notion is that physiological measures (such as corticosteroids in urine) be utilized to determine average stress levels in different kinds of housing arrangements.

Some conclusions that can be drawn from animal studies thus far are:

A. :"Crowding" is in large part a social phenomenon in that the same physical space may or may not be crowded, depending on how it is utilized for social interactions.

B. The effects of overcrowding can be very different, as different as are the individuals in the population. But generally individuals with high social rank will be less affected than lower ranked individuals. This is true for behavioral, "pathological," reproductive, and stress responses. Further, different modes of behavioral adaptation may occur. Some individuals may respond with extreme aggressiveness and hyperactivity, while others may engage in sleepwalking.

C. Effects of overcrowding are more profound for individuals who are born into an overcrowded population than for those who were raised in "better times" and merely had to deal with overcrowding as adults.

D. Population growth is not automatically regulated by overcrowding, but instead results from a number of behavioral and physiological changes that accompany overcrowding.

Title: PEOPLE PER SQUARE MILE* (Population Density)

Introduction:

Students often have no idea about how a country's population is related to its land area. This activity is designed to show students the relationship. Some statistics used in population studies can be misleading. Population per square mile is an example of misleading statistics. It is a measure that is standardized to aid in analysis, but it is not an accurate designation of where people are located. In this activity, students can practice understanding just what this statistic represents.

Objectives:

To determine the meaning of population per square mile statistics.

To suggest possible uses of population per square mile statistics in population studies.

Grade Level: 6-12

Time: One Class period

Materials: Copies of "People Per Square Mile" for every student
(Note to teacher: Fill in chart with countries used for the conference.)

Procedure:

1. Ask students what the statistic population per square mile means. Point out in an atlas how much a statistic is represented (by color coding). The students should be told that the statistic is an average to demonstrate the relationship between population numbers and land area.

2. Distribute "People Per Square Mile" to each student. Have students complete the chart.

3. Answer the questions using an atlas.
Discuss the work completed. How can the data be used for studying factors related to overpopulation?

4. Have the students make a visual picture of their country's population density using the people per square mile handout. (Other countries can also be done for comparison)

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*Adapted from an activity by Sharon Willsea, Aurora Public Schools, Aurora, Colorado. P. Heist, C. Stonebraker,

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PEOPLE PER SQUARE MILE?

The statistic, people per square mile, is used to demonstrate the relationship between population size and land area within a country. A country may have fewer people than another country but be more densely populated. This statistic explores that relationship.

Below are population figures and square mile figures for some selected countries. To find the number of people per square mile, divide the population by the square miles.

$$\frac{\text{population}}{\text{square mile}} = \frac{800{,}822{,}000}{3{,}746{,}000} = 214 \text{ people per square mile}$$

Then, using dots, letters, or whatever you choose, put the number of people per square mile in two 7" by 7" squares provided and write the name of the country. Do this chart for three or four countries.

Figure the population per square mile for all of the countries.

How Many People Per Square Mile?

	Square Mile Area	Population	Number of People Per Square Mile
Peoples Republic of China	3,746,00	800,822,000	214

1. List the countries in order of size from largest to smallest.

2. List the countries in order of population from most populated to least.

3. Compare the two lists. Why are they different?

4. What column on the chart tells how crowded a country is?

5. List the countries in order from most crowded to least.

6. Is the country with the largest population the most crowded? Explain.

7. Is the biggest country the least crowded? Explain.

8. Is the most crowded country the smallest? Explain.

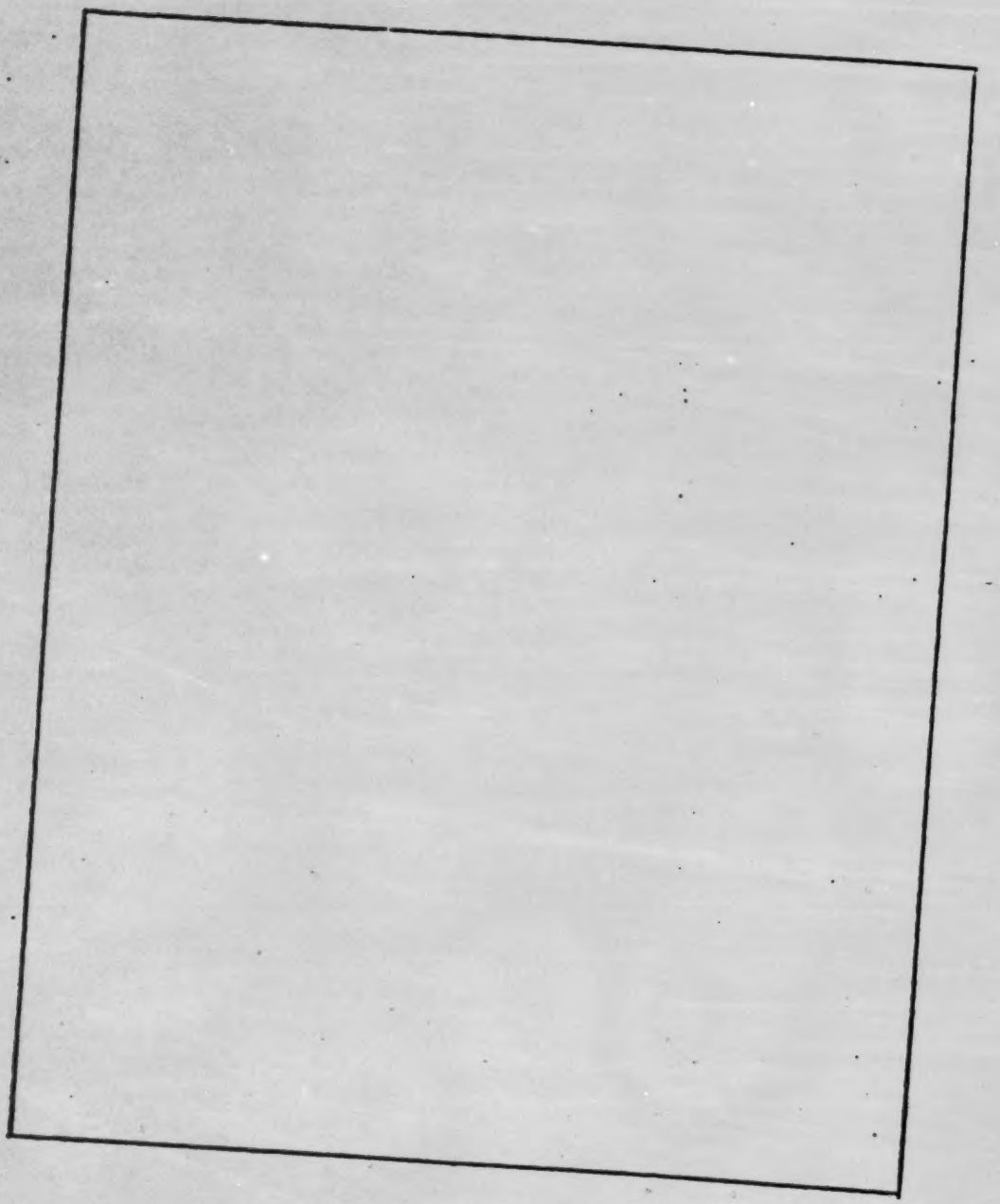
9. Which country would you like to live in? Why?

10. Which country would you least like to live in? Why?

11. Which statistic about a country gives the most true picture of a country's population.

12. Explain how you figure out a country's population density.

PEOPLE PER SQUARE MILE



Country

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Title: DOES STRENGTH LIE IN NUMBERS?*

Introduction:

Implicit in many of our daily actions is the value placed on numbers. For instance: "The bigger the better," "100%," "We have more washing machines than anybody else in the world." In fact, in many cases, quantity is our goal and not quality, although we might not like to admit it. This is not to suggest that people don't value quality, but it is to say that we often value quantity more.

Objectives:

To document the value of numbers (quantity) in the students' society by practices and customs that reveal attitudes toward numbers.

To consider the value of numbers by examining population data for selected countries around the world.

To explore data related to numbers to determine when numbers relate to quantity and when numbers relate to quality.

Grade Level: 7 - 12

Time: Two class periods

Materials: Duplicate copies of "Does Strength Lie in Numbers" for use during the second part of the activity.

Procedure:

1. Begin the activity by asking students to divide a sheet of paper into two columns. One column should be titled "More is Better" and the other "More is Worse." Ask the students to work alone or in pairs and identify situations where having more people or a bigger quantity is advantageous and where more is disadvantageous. Encourage the students by seeing who can get the largest list in the shortest time.

   Examples from the "More is Better" column might includes money, soldiers on your side in war, and miles per gallon you get on your car. Examples from the "More is Worse" column might be soldiers on the other side in war, number of pimples on the face, and number of pages to read for homework.

*Adapted from an activity by Margaret Palcynski, NSF Summer Institute, Cincinnati, Ohio, 1973.

2. Have students share their lists so that everyone gets some ideas about when numbers are valued as useful and desirable by students and when numbers are a hindrance to them.

3. The question to focus on at this point is: When is more of something valuable and when is it not? Ask students the following questions. As they answer the questions, list on the board the rationales given by students in their answers. This would provide a set of general statements about numbers and their values as students complete step 4.
   a. Is a $20 bill better than a $5 bill?
   b. Is a 200-page book better than an 85-page book?
   c. Is a 95 on a test better than a 93?
   d. Is a flower garden with 40 roses better than one with 30 roses?
   e. Is a family with eight children better than one with five?
   f. Is a nation with 200,000,000 people stronger than a nation with 30,000,000?
   g. Is a man with eight shirts better dressed than a man with five?
   h. Is a double dip ice cream cone better than a single dip?

   Make up your own questions or have students brainstorm some.

4. As the class examines the list you have compiled, raise this issue with them: "In responding to the questions, how many times did you feel that you were deciding on the basis of quantity vs. quality?" Give examples. Mention that many nations of the world today feel that strength lies in numbers. But the question is, what numbers? Hand out the worksheet titled "Does Strength Lie in Numbers?" and have the students complete them.

5. Summary. Ask the students if more of something is always good (they should say "no"). Is it always bad (they should say "no" again)? Then how does one determine when more of something is good (useful) and when it is bad (not useful)? Refer back to the list when answering these questions.

Evaluation:

Have the class discuss or write a reaction paper to this statement: "We as Americans are inconsistent since, most of the time, we value high numbers or quantity. It is not fair for us to be against nations with large populations or rapidly growing populations."

DOES STRENGTH LIE IN NUMBERS?

If you were a leader of a country, would you prefer to have a country

_____ with the highest total national income (Gross National Product)?
_____ with the largest population?
_____ with the highest income per person (per capita)?

What would be more advantageous in terms of your country's prospects for future progress and happiness?

Choose one of these questions or a combination of them and, then, use the following data to test your answer.

COUNTRY	POPULATION[1] (MILLIONS)	TOTAL NATIONAL[2] GNP (U.S. $ MILLIONS)	PER CAPITA[1] INCOME (U.S. $)
Australia	13.8	65,688	4,760
China	836.8	251,040	300
India	620.7	80,691	130
Mexico	62.3	62,300	1,000
Nigeria	64.7	15,528	240
Puerto Rico	3.2	7,680	2,400
United States	215.3	1,429,592	6,640

Now. . .refer to the above figures to answer the following questions:

1. List these countries by name in descending order.

highest	Population	Total National GNP	Per Capita
1.			
2.			
3.			
4.			
5.			
6.			
7.			
smallest			

2. Connect the same country across the three columns by a line. (E.g., from U.S. in first column to U.S. in second column to U.S. in third column.)

3a. Which is the largest country? Does it have the largest total income?

3b. Which is the smallest country? Does it have the smallest total income?

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[1]Source: 1976 World Population Data Sheet, Population Reference Bureau.
[2]Computed from these figures: population X per capita income = national GNP.

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3c. India, the second largest in population, has the second largest total income. Thus, India ranks second in terms of potential for progress and development. Comment.

3d. Why does India have a high total national income (GNP) and a low per capita income?

3e. How could India's per capita income also take second place in this list?

3f. Look at Puerto Rico. Its population is _____, and yet its GNP is _____, and its per capita is even_____.

4. Large populations and (high or low) per capita incomes do not usually go together. (Circle correct answer.)

5. If population size increases and total income does not, then per capita income will_____.

6. If population size decreases and total income remains the same, then per capita income will_____.

IN CONCLUSION:

7. Why is per capita income a better measure of a country's development and potential than its total national income?

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OPTIONAL

Title: WORLD POPULATION DATA SHEET*

Introduction:

The usefulness of data depends largely on the questions posed that concern the data. In the following exercise, the same data can be analyzed and examined in 34 different ways, documenting the use of population growth data.

Objectives:

To familiarize students with data on population growth and economic development.

To encourage students to use the data by listing and comparing data.

To encourage students to recognize the many uses of data in examining population dynamics.

Grade Level: 7-12

Time: One class period. The time will vary, depending on the number of activities planned.

Materials: You will need copies of the World Population Data Sheet. You can duplicate the 1974 data included with this activity or order large wall-size copies of the Data Sheet, at 35¢ each, from the Population Reference Bureau, Inc., P.O. Box 35012, Washington, D.C. 20013. Request the current copy of the World Population Data Sheet. The larger charts will have more impact with students, and it may be necessary to get only one chart for each five or six students. You will also need to duplicate the "Ideas" handout if the students are going to indicate their own choices of activities to complete.

Procedure:

1. Hand out the chart. Ask students to locate the five largest countries in the world. Explain how to read the chart and what the categories represent. This information is provided in the general notes on the chart.

2. Either identify some of the 34 activities and assign them to the students, or allow them to make their own choices or preferences.

---

*Many of the suggestions for using the data come from ideas generated by teachers at a University of Denver High School Conference on Food and Population.

Evaluation:

Discuss the results of each group's work, using any one of the following formats:

1. Have students report what information was learned by completing the statement, "I learned that _____."
2. Ask students to decide which of the activities provided them with the most new information. Share ideas with the entire group.
3. Have students explain how data are insufficient for grasping the entire picture of an issue. Which activity that was performed indicated this consideration the most vividly? Why?

IDEAS FOR USE OF WORLD POPULATION DATA SHEET

1. Hang it up and let students tell you what to do with it.

2. Shade (color) the world map according to birth and death rates, or any other data on the chart.

3. Given x amount of dollars, have students decide which country to aid and give reasons why based on the data sheet.

4. Why are there no statistics in certain columns?

5. List the 10 countries that have the highest and the 10 countries with the lowest growth rates. In groups, investigate cultural factors affecting this growth rate.

6. Middle East -- What does the information tell you about the present situation?

7. Relate figures to environmental factors, colonial background, energy consumption, dominant religion, etc.

8. By using the chart, students will be able to make a hypothesis about the relationship of population growth to per capita gross national product.

9. Students could take information from the chart and transform it to a graph.

10. Which countries will double in population first? Last?

11. Which geographic region has the most people now? Which will have the most in 1985?

12. Have students figure out five or ten ways in which they can categorize the data they have. For example, the places I would not want to live in; the places that are like the United States.

13. Can you identify the "developing" nations? What factors do you use to identify them?

14. Politically, where are the most populous countries? Economically? Culturally?

15. Are there any countries that have reached or are fast approaching zero population growth? Reasons?

16. Find the "worst" place in the world to live. The "best" place.

17. Using the data, write a one-page definition of the population "problem" that the world is facing.

18. Choose one country. Describe the quality of life there, using information from a journal, short story, poem, cartoon, or drawing.

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19. Find descriptive pictures of one country that show some of its statistical data.

20. Relationship of population numbers or GNP to physical size of a country.

21. Space activity
    -- multiply people by birth rate and have students interact with the results
    -- first students occupy the total space in the room
    -- then with new statistics decrease space likewise to accommodate new statistics
    -- continue to decrease space by increasing population in terms of future population projections
    -- ask students feelings on continued population/space relationship -- problems and prospects

22. From data on the sheet, write a paper proving a certain point. Then, take the oppostie point of view and prove it from the data on the sheet.

23. For countries, find out the average per capita income of the "haves" and the "have nots."

24. Which countries would food aid help the most?

25. Is there any relationship between the population growth of a country and its form of government?

26. By using a graph, make a comparison between any two factors you choose.

27. Number of years to double populations -- activity designed to find out how many countries of the world will have doubled their population by the time the student is 30 years old, 40, 50, or 75.

28. Simulation idea -- population or food conference using sections of the world or key countries. Every 10 minutes = 1 year. Compute changes in figures if no agreement is reached on population control measures. Goal is to sense pressures to come to some decision.

29. Identify a place you'd like to live in other than the United States, using data to describe the life you might have there. How would you view the United States from the country you choose?

30. Choose five or six regions. Have groups of students examine the data sheet and describe national priorities as if they are the political leaders of that country.

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31. You are pregnant, live in the following cities, and can buy an airplane ticket with your per capita gross national product ($1 goes 2 miles). From each city, where can you go to increase your child's life expectancy the most?

Brasilia, Brazil
Peking, China
Calcutta, India
Kabul, Afghanistan
Niwot, Colorado

32. What information is included on the Data Sheet that is not included in an almanac covering the same countries?

33. Write to the Bureau of Census to get the figures that would belong in each column for your state (Colorado, New Mexico, etc.).

34. Donut activity

1. From an almanac, cut out all the colored flags for each nation. (You will need two almanacs to get all flags.) Place a number on the back to help you identify the country.

2. Don't explain anything about the exercise. Tell the students to pick any flag. (Teacher usually "pulls" U.S. for self.)

3. Student registers nation, is given population and rate of growth (<u>not</u> per capita income). They are assigned the task of getting certain information about the nation, then predicting what the future of the nation is.

4. Teacher (later that day) records per capita income for each nation, then totals all P.C.I. Buy <u>one donut</u> for <u>each</u> $1,000 P.C.I.

   (Example: $24,000 = 24.6 or 25 donuts)

5. Next day, seat students by continent. Call each student forward, tell him of 1 donut per $1,000, then give him his "share" of the world's wealth (e.g. $120 gets 1/8 donut). A variation is to use "high quality" donuts for the U.S. and Europe, "medium quality" for some other ($500-$2,000 P.C.I.), and "plain donuts" for underdeveloped nations.

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Estimating Population of World and Individual Countries for Mid-1975

For almost all countries, the midyear 1975 estimates presented here were derived from the midyear 1974 Government or United Nations' estimate for that country. That estimate was projected to midyear 1975 by applying what was considered to be an appropriate growth rate for the 1-year period. In most instances the growth rate used was that experienced by the country in the 1973-74 or the 1972-74 periods or that is implied for the 1970-75 period by the United Nations' population projections as assessed in 1973 (medium variant).

Other methods used to derive midyear 1975 population estimates would usually result in different figures. One generally accepted method is to project the separate components of population change; that is, to apply fertility, mortality, and international migration assumptions to the latest age-sex distribution--usually data derived from the latest census. Such longer range projections may vary from the 1-year projections presented here because of two principal factors: (1) whether or not the 1974 Government or United Nations population estimates are accepted as valid; and (2) whether or not the 1974 estimates or the base data for the projections take underenumeration into account; i.e., the population totals are increased on the basis of knowledge regarding the degree to which the latest census underenumerated the population. Also, differences in timing and other factors may result in estimates which differ from those officially accepted by the various countries.

It is not known whether the estimates presented here are closer to the actual populations in the various countries than those which would result from the longer range component projections or from other projection techniques, particularly those based on adjusted totals and age-sex distributions. It would be fortuitous if any estimate now were to prove identical with the final official figure when the latter is known, but it is believed that the estimates given here by the Population Reference Bureau are technically sound, although differing in some cases with estimates from other sources.

*World Population Growth and Response: 1965-1975, A Decade of Global Action (Washington, D.C.: Population Reference Bureau, 1976), pp. 246-270.

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Zero Population Growth

Since its establishment in 1968, Zero Population Growth, Inc. (ZPG) has conducted and supported programs of education and information "stressing the need for achieving zero population growth in the United States and elsewhere as soon as possible." By mid-1975, ZPG had a nationwide membership of about 10,000 and a network of 100 chapters. It is the only registered national population lobby.

In the spring of 1975, the organization reaffirmed its long-standing interests in promoting small families, improving birth control options, preserving the right to select abortion, and reducing immigration to the United States. At the same time, it has stepped up attention to population distribution and per capita consumption of natural resources. ZPG is currently giving detailed consideration to the possible components of a comprehensive U.S. policy on population size and distribution.

Combining these new initiatives with traditional concerns, ZPG is presently working to foster public attitudes supportive of small families, child-free couples, fertility control, population stabilization, provision of fertility control services to all persons, reduction in levels of teen-age pregnancy, U.S. assistance for fertility-control programs in other nations and for stabilization of the world population. ZPG is also working to lower levels of per capita resource consumption in the United States and to stimulate stewardship of U.S. land resources and desired policies in growth-determinant fields such as transportation and other public facilities.

ZPG assigns top priority to educational work with public officials and to broad public education on population matters through news media, its newsletter, special studies and reports, and work with a special correspondence group.

Its school-oriented role is one of encouraging school systems at regional and State levels to apply modern population education concepts. Heavily involved in past years with the development of population education materials and curricula for use on the Nation's schools, ZPG has recently decided that it should now concentrate on the implementation of such materials and curricula.

Note: *It is recognized that, in addition to the organizations discussed above, scores of other institutions and organizations in the United States and elsewhere throughout the world also have given attention to population matters during the 1965-75 decade. The above descriptions cover the most significant of such activities for which information has been available to the Population Reference Bureau. Of special note have been the activities of many U.S. universities and colleges in the area of population studies and technical assistance. A number of foreign organizations and foundations, including the Colombo Plan, also have rendered valuable assistance to population programs during the decade.*

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WORLD POPULATION DATA[1]

Region and country	Estimated population, July 1, 1975	Births per 1,000 population[2]	Deaths per 1,000 population[2]	Rate of natural increase	Time to double population[3]	Population under age 15	Life expectancy at birth	Urban population	GNP per capita[4]
	Thousands	*Number*	*Number*	*Percent*	*Years*	*Percent*	*Years*	*Percent*	*Dollars*
World	3,947,039	30	12	1.8	38	36	59	38	1,250
Northern America	236,552	15	9	0.6	116	27	71	74	6,130
Bermuda	55	19	7	1.2	58	30	69	100	4,710
Canada	22,811	15	7	0.8	87	29	73	76	5,370
Greenland	50	20	6	1.4	50	43	61	67	2,780
St. Pierre and Miquelon	5	30	13	1.7	41	32	NA	NA	NA
United States (the 50 States and the District of Columbia)	213,631	15	9	0.6	116	27	71	74	6,210
Latin America (Mainland)	290,271	38	9	2.9	24	42	62	60	770
Argentina	25,376	22	9	1.3	53	29	68	81	1,250
Belize	139	39	5	3.4	20	49	NA	54	700
Bolivia	5,612	44	18	2.6	27	43	47	35	200
Brazil	107,162	37	9	2.8	25	42	61	58	750
Chile	10,585	28	8	[5]1.9	36	39	63	76	780
Colombia	22,273	41	9	3.2	22	46	61	64	410
Costa Rica	1,967	28	5	2.3	30	42	69	41	780
Ecuador	6,716	42	10	3.2	22	47	60	39	370
El Salvador	4,099	40	8	3.2	22	46	58	39	340
Falkland Islands	2	20	6	1.4	50	27	NA	55	NA
French Guiana	55	37	9	2.8	25	38	NA	66	1,000
Guatemala	5,509	43	15	2.8	25	44	53	34	450
Guyana	786	36	6	3.0	23	44	68	40	380
Honduras	2,747	49	14	3.5	20	47	54	28	290
Mexico	60,152	46	8	[10]3.8	18	46	63	61	870
Nicaragua	2,153	48	14	3.4	20	48	53	49	500
Panama	1,668	31	5	2.6	27	43	66	49	900
Panama Canal Zone	40	14	2	[5]1.1	63	32	NA	6	2,910
Paraguay	2,547	40	9	3.1	22	45	62	38	400
Peru	15,510	41	12	2.9	24	44	56	60	620
Surinam	416	41	7	3.4	20	50	66	49	880
Uruguay	2,764	21	10	1.1	63	28	70	80	860
Venezuela	11,993	36	7	2.9	24	44	65	75	1,360
Caribbean Islands	26,812	31	9	2.2	32	41	64	43	780
Antigua	73	18	7	1.1	63	43	62	40	480
Bahama Islands	205	22	6	[5]1.7	41	44	66	58	2,320
Barbados	239	21	9	1.2	58	34	69	4	950
British Virgin Islands	11	25	6	1.9	36	39	52	12	NA
Cayman Islands	12	32	8	2.4	29	39	NA	39	NA
Cuba	9,252	25	6	[5]2.0	35	37	70	60	540
Dominica	75	36	10	2.6	27	49	58	17	360
Dominican Republic	4,694	46	11	3.5	20	48	58	40	510
Grenada	96	26	8	[5]1.9	36	47	63	8	460
Guadeloupe	352	28	7	2.1	33	40	69	9	1,050
Haiti	4,574	36	16	2.0	35	41	50	20	130
Jamaica	2,052	31	7	2.4	29	46	68	37	870
Martinique	347	22	7	[5]1.6	43	41	69	33	1,330
Montserrat	11	25	9	1.6	43	40	52	11	NA
Netherlands Antilles	233	25	7	1.8	38	38	73	32	1,650
Puerto Rico	3,128	23	6	1.7	41	37	72	58	2,270

See footnotes at end of table.

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World Population Data—1965 and 1975 Compared

Region	Estimated population, July 1		Births per 1,000 population		Deaths per 1,000 population		Rate of natural increase		Time to double population[1]		GNP per capita[3]	
	1965	1975	1965	1974[2]	1965	1974[2]	1965	1974[2]	1965	1974[2]	1965	1973
	Thousands	*Thousands*	*Number*	*Number*	*Number*	*Number*	*Percent*	*Percent*	*Years*	*Years*	*Dollars*	*Dollars*
World	3,289,308	3,947,039	34	30	15	12	1.9	1.8	36	38	920	1,250
Northern America	214,073	236,552	20	15	9	9	[4]1.0	0.6	69	116	4,950	6,130
Latin America	241,078	317,083	39	37	11	9	2.8	2.8	25	25	590	770
Mainland	218,998	290,271	39	38	11	9	2.8	2.9	25	24	590	770
Caribbean Islands	22,080	26,812	36	31	10	9	2.6	2.2	27	32	560	780
Europe[5]	666,604	718,682	18	16	9	10	0.9	0.6	77	116	1,900	3,010
Africa[6]	278,176	365,003	48	47	23	21	2.5	2.6	28	27	250	310
Near East[7]	126,270	163,536	42	41	16	14	2.6	[4]2.6	27	27	470	710
South Asia	635,210	799,886	44	38	20	16	2.4	2.2	29	32	110	120
South East Asia	247,911	319,281	44	38	18	15	2.6	[4]2.4	27	29	140	180
East Asia	862,433	1,005,787	33	26	15	9	1.8	1.7	38	41	350	680
Oceania	17,553	21,229	24	22	10	10	1.4	1.2	50	58	2,660	3,300

[1]Based on the rate of natural increase shown and assuming no change in the rate.

[2]Data refer to 1973, 1974, or to the 1970-75 period.

[3]For the Communist countries and for nearly all countries with populations of less than 1 million, the estimates were derived by applying the annual growth rate for the 1965-72 period to the 1972 estimate. The figures were published in the 1974 edition of the *World Bank Atlas: Population, Per Capita Product and Growth Rates.* The 1972 estimates are in market prices and are based on a multiyear period (1965-71) to convert domestic currencies to dollars. For the remaining countries, the figures are in 1973 constant dollar equivalents.

[4]Difference due to rounding of birth and death rates.

[5]Excludes Greece, shown in Near East section of World Population Data, page 269, and includes over 60 million in Asiatic U.S.S.R. See text.

[6]Excludes population of Egypt, shown in Near East section of *World Population Data*, page 269. See text.

[7]Excluding Greece as European, 1975 total for Near East as 117.3 million.

Note: For general sources and methods, see the notes of the table **World Population Data.** The estimates given above are the weighted averages for the countries within each region for which data are available or estimates were derived.

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Title: LIMITS*

Introduction:

Space on this earth is limited. It is finite. The number of people who can live on this earth is determined by many factors, such as food, land, water, and quality of air. But there is a limit somewhere to that number. This exercise helps students understand that there are finite boundaries to most situations, and these limits depend upon our assumptions. This activity will illustrate that available space in which to fit things is finite. The examples show the difficulty of predicting exact limits, even though we know that ultimate limits exist. There is a finite surface area available to hold a given population. The maximum population cannot be determined exactly, but there is a maximum.

Objectives:

To utilize math skills to calculate the maximum number of inanimate objects which can fit into a given space.

To recognize that the maximum number of animate and inanimate objects which can live in a space depends upon complex assumptions.

To distinguish between maximum possible and desirable population size.

Grade Level:

Time: one 50-minute class period

Materials: Copies of "Limits Problems" for each student

Procedure:

1. Tell the students that you would like them to work some puzzle problems which involve calculating how many objects will fit into certain spaces. Hand out the Limits Problems and let students work on them for 15-20 minutes.

2. Discuss the work the class has done.

*Adapted from an activity in An Introduction to Population, Environment, and Society by Lawrence Schaefer (New Haven, Conn: E-P Education Services, 1972).

3. What is the difference between the maximum possible amount that a space can hold, and the desired population of objects for that space? In which of the situations students worked on would they feel it is desirable to have less than maximum occupation?

4. What factors would students consider in determining the desirable number of people for the world (nation, town)? What factors would students consider in determining the maximum human population possible for the world (nation, town)? What are the similarities and differences in the two lists?

Further Suggestions:

1. In conjunction with Step 4, have students break into groups and list the factors which also work to establish limits on desirable occupation for given areas, e.g. environmental factors and terrain. Are limits established by these factors as well as by the consideration of sheer space availability?

2. Have students think of other problems that deal with putting something into a particular space. Print these, and let students work on them for credit, or as a contest activity.

LIMITS PROBLEMS

1. How many shoe boxes (1/2 ft. x 1 ft.) will fit into a steamer trunk (3 ft. x 3 ft. x 5 ft.)?

   Answer: volume of shoe box $v = l \times w \times h = 1/6$ ft.^{3}

   volume of steamer trunk $v = 45$ ft.^{3}

   $$\#\text{ of objects} = \frac{\text{volume of large area}}{\text{volume of single object}} = \frac{45 \text{ ft.}^3}{1/6 \text{ ft.}^3/\text{box}}$$

   = 270 boxes, an exact number

2. How many cars can fit on a parking lot (300 ft. x 150)?

   Answer: Some possible assumptions: Car size?
   Do you leave aisles?
   How many levels?

   A student can make any assumptions for car size --
   for 7' x 12' and no aisles
   area car -- 84 ft.^{2}/car
   area lot -- 45,000 ft.^{2}

   $$\#\text{ of cars} = \frac{45{,}000 \text{ ft.}^2}{84 \text{ ft.}^2/\text{car}} = 525 \text{ cars}$$
   range 300 - 1,000 cars

   There is more than one reasonable answer.

3. How many houses will fit on 100 acres of land?

   Answer: Possible assumptions: number of streets
   open spaces
   recreation areas
   number of houses per acre

   Assume - 1 house occupies 1/4 acre
   Answer: 400 houses maximum

   Assume - 1 house occupies 2 acres
   Answer: 50 houses maximum

4. How many people can live in your apartment or home?

   Answer: Assumptions: nationality
   size of home
   number of bedrooms
   how long will they stay - a weekend or year?
   zoning

   Range: 2 - 50

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Discuss: How they make their choice?
Did they need privacy?
Did they need room to feed people?
Did they need recreation area?
Did they need empty space?

5. How many students will your classroom hold? Comfortably?

Answer: Value judgement: 15 - 30 students
A teacher may relate the students' answer to population growth later. As population grows either more classrooms must be built or more students must go in each classroom. Do the students feel a small class size maximizes learning? What effect does a large class have on learning?

6. What is the maximum number of people that can live in your city or town?

Answer: Open ended. Emphasize the difficulty of predicting a maximum population for such a large area. The class should realize that, even though the limit cannot be exactly predicted, a finite limit exists on the number of people that can be accommodated. Discuss the importance of resources such as food and water. Have the class distinguish between absolute limits and desirable numbers.

Optional:

7. How many fish can live in a 20 gallon aquarium?

Answer: Assumption: size of aquarium
size of fish
type of fish
oxygen source - plants or mechanical?

No correct answer. Allow discussion to include need for life support, e.g. food, oxygen, spawning area, waste removal.

Generally, goldfish need 1 gallon of water for every 2 1/2 inches of body.

8. How many people will fit in a car?

Answer: Assumption: size of car
size of people

Range: 2 - 9 people

9. How many cows can live in a 2 acre pasture?

Answer: On Western grassland, each cow needs approximately 5 acres for grazing. If a farmer provides food from an external source, more cattle can be accommodated in a smaller area, e.g. feedlots. In a feedlot, 100/300 cattle/acre.

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LIMITS PROBLEMS

1. How many shoe boxes (1/2 x 1/3 x 1 ft.) will fit into a steamer trunk (3 ft. x 3 ft. x 5 ft.)?

2. How many cars can fit on a parking lot (300 ft. x 150 ft.)?

3. How many houses will fit on 100 acres of land?

4. How many people can live in your apartment or home?

5. How many students will your classroom hold? Comfortably?

6. What is the maximum number of people that can live in your city or town?

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EXPONENTIAL GROWTH

If our appetite for energy continues to grow at 3% per year, our energy requirements will double in the next 25 years. Said another way, we will have to find as much energy in the next 25 years as we have used throughout our entire history. Doubling anything repeatedly can yield staggering results. Imagine doubling your weight every 25 years from your present age. By the time you were 80, you'd weigh 600 pounds! At 30 you'd weigh 150 pounds, at 31, 154.5 pounds, at 40 you'd be obese, at 50 you'd have to have special chairs and cars, and by 60 you'd be on the 6 o'clock news!

This packet deals with the concept of exponential growth in a way that will help students understand the choices concerning energy, population, and environment that will shape their future. These topics involve very large numbers,so the first lesson gives students a "feel" for large numbers.

Exponential growth in our world is driven by population and in the U.S. by per capita consumption. The quantities describing these two forces are doubling at a fixed rate. This is a consequence of exponential growth. Repeated doubling within a finite world leads to exhaustion of resources. The concept of finiteness is an integral part of growth on this planet.

The consequences of growth are bringing changes to our cities and communities. These local changes are but extensions of global changes that can't be ignored. Examining priorities and the dimensions of the quality of life always accompanies change. Awareness of alternatives is a prerequisite for responsible decision-making. This packet gives the students some material to get the process started.

Bringing future consequences to bear on the present is a job that takes time and effort. It is the job of teachers and leaders. The job requires that we reveal the immense burden without depressing the spirit.

Experimental material developed for the Project for an Energy Enriched Curriculum, National Science Teachers Association, Boulder, Colorado, 1978.

ACTIVITY TITLE: QUICK HITTERS

These "Quick Hitters" introduce the topic of exponential growth. They are designed to arouse curiosity in the dynamics of exponential growth. From one or more of these motivational activities the students can then progress into a more detailed look at the characteristics of exponential growth.

Materials: Copies of student hand-outs (riddles)
- A Hero's Reward
- Multiplying By Division
- Save the Lily Pond
- A Foolish Son?
- Want to Buy My Chessboard?

Procedure:

1. Begin the lesson with a fun activity which presents students with a series of riddles. Each riddle demonstrates the point that when things grow exponentially, enormous increases in resources are consumed in a very short time.

2. Divide the class into four groups. Distribute one riddle to each group. Allow 10 minutes for a group to solve a riddle. Then set up a system of group rotation that will give the rest of the class an opportunity to solve each riddle. Once groups have the answer to their first riddle, they should be able to solve the others fairly quickly. They should also gain expertise in recognizing exponential growth as they attempt to solve the riddles.

OPTIONAL: At the teacher's discretion, brief group presentations can be given to make sure exponential growth is understood by all students.

3. Besides the data given in the riddles, what other things do students think grow exponentially?

4. Close this activity by asking students to characterize exponential growth by completing the following sentence:

   "Exponential growth is _____."

EXTENDED ACTIVITIES: As a follow-up activity, ask students to write their own riddles, including illustrations and try to "stump" the rest of the class.

A HERO'S REWARD

The king of an ancient country was bored with his court jester. He offered a reward to anyone who could provide him with some new entertainment. The reward could be anything the entertainer asked.

After several months a pauper arrived at the castle. He taught the king to play a new game, chess. The king liked this new game. When it came time for the pauper to leave the kingdom, the king asked him what he would like as his reward.

"My needs are simple," said the pauper. "If you will give me as much wheat as will go on this chessboard in a certain order, I will be happy."

"What do you mean?" questioned the king. "Wheat on a chessboard is ALL you want?" You've entertained me more than any of my jesters. Surely you deserve more-- much more."

"Thank you, kind king. But if you will place one grain of wheat on the first square, two on the second, four on the third, eight on the fourth square,and so on, the amount being doubled each time, I will be quite content."

Again the king protested. This just wasn't enough for all the pauper had done for him.

"You gave me your word, king! You promised I could have what I asked!" said the pauper.

And so the king agreed. He ordered his officials to bring him a sack of wheat.

How much wheat did the pauper receive?

MULTIPLYING BY DIVISION

Bacteria multiply by division (pretty odd, huh?) so that one bacterium becomes 2, the two divide to give 4, the 4 divide to give 8 and so on. For a certain strain of bacteria the time for this division process is one minute. If you put one bacterium in a bottle at 11:00 AM, by noon the entire bottle will be full.

1. When was the bottle half-full?

2. If you were an average bacterium in this bottle, at what time would you first realize that you were running out of space?

3. Suppose that at 11:58 some farsighted bacteria realize that they are running out of space in the bottle. So they launch a search for new bottles. They look far and wide. Finally offshore in the Arctic Ocean they find three new empty bottles. Great sighs of relief come from all the bacteria. This number if <u>three</u> <u>times</u> the number of bottles that they've ever known. Surely, their space problems are over.

4. Are the bacteria's space problems ended? Since their space resources have quadrupled, how long can their growth continue?

SAVE THE LILY POND

Suppose you own a pond on which a water lily is growing. The lily doubles in size each day. If the lily were allowed to grow unchecked, it would completely cover the pond in 30 days, choking off the other forms of life in the water. For a long time the lily plant seems small and you decide not to worry about cutting it back until it covers half the pond. On what day will that be?

A FOOLISH SON?

A father complained that his son's allowance of $5.00 per week was too much. The son replied, "Okay, Dad. How about this? You give me a penny for the first day of the month, 2¢ for the next, 4¢ for the next, 8¢ for the next, and so on for every day of the month." The father, thinking he had a foolish son, readily consented.

Who, indeed, was the more clever?

TEACHER EXPLANATIONS:

A HERO'S REWARD: How much wheat does the "pauper" receive from the king? By following the pauper's instructions, you will have 2^{63} grains on the 64th square (the last square on the chessboard) and the total grains on the board will be one grain less than 2^{64}. How much wheat is 2^{64}? Simple arithmetic shows that is is approximately 500 times the current annual harvest of wheat in the ENTIRE WORLD. This amount is probably larger than all the wheat that has been harvested in the history of mankind. How did the pauper get this enormous number? He started with one grain of wheat and doubled it a mere 63 times.

MULTIPLYING BY DIVISION?

1. The bottle was half full at 11:59 AM.
2. Ask students: At 11:55 AM, when the bottle was only 3% filled and 97% empty, how many of you would perceive that there was a space problem?

3,4. With space resources quadrupled, the bacterium have two more doubling times, or two minutes before they will run out of space.

11:58 AM Bottle No. 1 is one-quarter full
11:59 AM Bottle No. 1 is half-full
12:00 NOON Bottle No. 1 is full
12:01 PM Bottles No. 1 and 2 are both full
12:02 PM Bottles No. 1, 2, 3 and 4 are all full

When things grow exponentially, enormous increases in resources are consumed in a very short time.

SAVE THE LILY POND

The answer to the problem is the 29th day. One the 29th day the lily would cover half the pond. <u>You have one day to save the pond</u>.

An extension of the "Lily Pond Riddle": Distribute graph paper (4 to the inch is best). Have students mark off a big square with 32 small squares on each side. This represents the pond. If the lily plant would have complet ly filled this pond on the 30th day, how many of the small squares did it occupy on the 20th day? Have students guess before they begin to figure.

The simplest way of arriving at a solution is to work backwards, like a time-lapse movie run in reverse. First divide the pond in half and label one half '30'. This is the position that was added on the thirtieth day. Then divide the remaining half in half again and label one portion of the '29'. Continue in the same fashion, dividing the unlabelled half of each segment in half again until you reach the number 21. The remaining portion will be a single square, the total size of the plant on the 20th day.

A Foolish Son?

The son's allowance:

Day 1	.01	Day 17	655.36
Day 2	.02	Day 18	1,310.72
Day 3	.04	Day 19	2,621.44
Day 4	.08	Day 20	5,242.88
Day 5	.16	Day 21	10,485.76
Day 6	.32	Day 22	20,971.52
Day 7	.64	Day 23	41,943.04
Day 8	1.28	Day 24	83,886.08
Day 9	2.56	Day 25	167,088.64
Day 10	5.12	Day 26	335,544.32
Day 11	10.24	Day 27	671,088.64
Day 12	20.48	Day 28	1,342,177.28
Day 13	40.96	Day 29	2,684,354.56
Day 14	81.92	Day 30	5,368,709.12
Day 15	163.84	Day 31	10,737,418.24
Day 16	327.68		

Want to Buy My Chessboard?
(Optional Activity)

1. Show students a beautiful looking chess board if possible. If no chess board is available a verbal description of a very expensive sounding board will do.
2. Offer to sell it to them for only 1 penny for the first square and keep doubling for each additional square. In other words, the second square will cost 2¢, the third square will cost 4¢, the fourth will cost 8¢, etc.
3. Ask how many want to buy a chessboard like the one described at this cost. If any want to, then pass them the sales contract and have them sign it.
4. Have those that respond (or the entire class) attempt to compute the cost. Before very long the students realize due to the "expoential growth" pattern, the cost becomes prohibitive. The fifteenth square, for instance, costs $168.84. The twenty-first square will be over $10,000,00. There is a total of 64 squares
5. Perhaps some students will want to continue the doubling until the 64th square, but you may want to have them do it on their own time. It will take quite an effort. The answer is_____

SALES CONTRACT

I do hereby agree to purchase the chessboard described by my teacher _____(name) on the date of _____ _____ and witnessed by the students of the _____ period class for the purchase price described below.

Purchase price:

$ .01 for the first square
.02 for the second square
.04 for the third square
.08 for the fourth square
(double the price for each consecutive square)

Title: POPULATION PROJECTIONS*

Introduction: In this activity, students use calculators to understand exponential growth and make simple population projections.

Objectives:

To help students understand exponential growth by using calculators.

To make population projections with calculators.

Grade Level: 6-12

Time: One class period for every two worksheets attempted

Materials: At least one standard calculator (pocket-type is fine) for every two or three students in your class; copies of "Calculating Population Growth" worksheet for each student.

Procedure:

1. Hand out the worksheets to students.
2. Discuss the initial reading with the students after they have read it.
3. Have students complete the worksheets.

*This activity was developed by John Masoncup.

CALCULATING POPULATION GROWTH

Assumptions about Exponential Population Growth Rates

Population growth is exponential. Exponents are used in mathematics as a shorthand to denote repeated multiplication. For example, in the number 10^7, 7 is an exponent. The 7 means you multiply by 10 seven times: 10x10x10x10x10x10x10. Population grows exponentially because it is repeatedly multiplied by a number called the growth rate. Thus, if a world population of 4 billion has a growth rate of 2% per year for 7 years, the population will be $4\ (1.02)^7$ billion.

The growth rate represents the net gain of people per year. Roughly speaking, the birth rate - the death rate = the growth rate. Thus, to decrease the growth rate there must be a decrease in the birth rate or an increase in the death rate, or a combination of the two. People moving in and out by migration also have to be added and subtracted, but on a national basis the long-term effects of migration are usually less than those of births and deaths.

The significant fact about exponential growth is that even small growth rates lead to a large overall growth in population. Further, the growth is much faster than you might expect. For instance, it seems reasonable that with a growth rate of 2% the world population would double in fifty years to make a 100% increase. But in reality a growth rate of 2% causes a doubling of the population in only 35 years. This is because exponential growth is compounded much like compounded interest in a bank account.

A skeptic may well observe that these population projections may be true in theory, but that the predictions are not accurate because the growth rate will probably not remain constant. Such skepticism is well justified because, in fact, population growth rates do vary depending on a variety of social and cultural factors. Are population projections therefore worthless? Are the prophets of doom unduly alarming the public? Isn't it quite likely that the population will not grow as large as predicted, and so there is really nothing to get excited about?

Remember, the growth rate will decline only if the birth rate is decreased or the death rate is increased. Thus, if we expect the growth rate to decline, are we anticipating a reduction in birth rate? If so, what policies are now in effect or what social movements are occurring that will decrease the birth rate? Or perhaps we see trends that will lead to an increase in the death rate. The interplay between a variety of factors influencing birth rates and death rates will cause the overall growth rate to vary. But even if the growth rate is reduced, as long as it is greater than zero we have not resolved the conflict imposed by an exponentially growing population dependent upon limited resources. We have simply bought some time.*

There is also the question of lead time. If the leaders of a country decide to try to decrease the growth rate by decreasing the birth rate, they will not be able to accomplish this overnight. It could take at least

*Paul Ehrlich, The Population Bomb, Ballantine Books, New York, N.Y., 1970, pp. 34-35.

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a generation to effect the policies and for the reduction to have a significant effect in leveling off the population growth. (To understand this effect better, run some experimental data in Option 6 of the POPPAK computer program.)

In conclusion, population projections cannot accurately tell us what the population will be in some future year because growth rates are neither constant nor perfectly predictable. But they can warn us of the worst possible consequences of continued growth at present rates or give us some idea of the best possible outcome of reduced rates. And hopefully, such projections can stimulate discussion of the perplexing alternatives that must be considered among different methods of changing the growth rate.

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CALCULATING POPULATION GROWTH WORKSHEET #1

Using a Calculator to Compute Population Growth

To use % growth rates on a calculator, change the % to a decimal and add 1. Complete the table.

	% of growth rate	decimal rate	each year multiply by
1)	.8%	.008	1.008
2)	1.5%	.015	1.015
3)	2.0%	.02	1.02
4)	3.4%		
5)	1%		
6)	.5%		
7)	2.2%		
8)	3%		
9)	2.9%		
10)	1.7%		

To find the decimal rate, take the % rate and move the decimal point 2 (two) places to the left.

To find what number to multiply by, put a 1 in front of the decimal rate.

If your calculator has a memory, store the rate you multiply by each year so you won't have to punch it in each time.

If your calculator has a % key, you do not need to change the growth rate to a decimal. For instance, if the growth rate is 1.5%, enter the population and just punch + 1.5 % = for each year of growth.

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CALCULATING POPULATION GROWTH WORKSHEET #2

Projecting Population Growth with a Calculator

In 1970 Mexico's population was 50.7 million, and its annual growth rate was 3.4%. If this growth rate stays the same, what will the population be in 2000? (3.4% = .034 Each year, multiply by 1.034.)

Year	Population	Year	Population
1970	50.7	1986	
1971	50.7x1.034=52.4	1987	
1972	52.4x1.034=	1988	
1973		1989	
1974		1990	
1975		1991	
1976		1992	
1977		1993	
1978		1994	
1979		1995	
1980		1996	
1981		1997	
1982		1998	
1983		1999	
1984		2000	
1985			

In 1976 the population of the U.S. = 220 million and the growth rate = 1.0%. Construct a similar population chart for the U.S. going to the year 2000.

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CALCULATING POPULATION GROWTH WORKSHEET #2A

Bar Graph for the Population Growth of Mexico

Use your results on Worksheet #2 to construct a bar graph.

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CALCULATING POPULATION GROWTH WORKSHEET #3

The Population Race

In 1970 Mexico's population was 50.7 million and the growth rate was 3.4%. In that year, the population of the U.S. was 206.2 and the growth rate was 1.0%. If the growth rates remain the same, in what year will the population of Mexico surpass the population of the U.S.?

Use two calculators, one for you and one for your partner. Calculate the growth of the U.S. while your partner calculates the growth of Mexico. After each calculation, compare answers. Keep track of the number of multiplications needed before Mexico passes the U.S. Write the year, the future population of Mexico in that year, and the population of the U.S. in that year.

1) Number of years for Mexico to pass U.S. _____

2) Year when Mexico passes U.S. +1970 _____

3) Population of Mexico _____

4) Population of U.S. _____

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CALCULATING POPULATION GROWTH WORKSHEET #4

Finding Doubling Times on a Calculator

In 1976 the population of the world was 4 billion and the growth rate was 2%. If that growth rate continues, how many years will it take the world's population to double?

Enter 4 on your calculator. Repeatedly multiply by 1.02. Count how many times you have to multiply to obtain 8 or more for your answer.

Doubling time = _____ years.

Doubling time depends on growth rate, not on population. In 1970 the growth rate of both Mexico and the Phillippines was 3.4%. How many years will it take for the population to double if the growth rate is 3.4%?

Enter 1 on your calculator. Repeatedly multiply by 1.034. Count how many times you have to multiply to obtain 2 or more for your answer.

Doubling time = _____ years.

Find the doubling times for the following growth rates.

Growth rate	Doubling time	Growth rate	Doubling time
.5%		2.5%	
1.0%		3.0%	
1.5%		3.5%	
2.0%		4.0%	

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Title: GRAPHING POPULATION GROWTH

Introduction:

Why are many people concerned about population growth today? One reason is that population grows exponentially. This activity demonstrates how a population grows regardless of the human population we consider. Students can learn about the growth of a population by reading graphs. Making a graph on population growth for the nation and then comparing this growth to world population growth wil help students understand and read graphs and also understand the exponential nature of population growth.

Objectives:

To make a live graph, given raw data.

To compare the data on a graph of U.S. population and their assigned country with a graph of world population.

To figure the doubling time of various populations, both animate and inanimate.

Grade Level: 7 - 12

Time: One class period

Materials:

Duplicate two sheets of graph paper for each student. You may give the data for the graph on either a separate handout, an overhead transparency, or the chalkboard. Duplicate graph of World Population Growth for students.

Procedure:

1. Hand out graph paper, U.S. data, and data for their countries to students.

2. Have students graph the data.

3. Ask students why the curve rises sharply and quickly on the graph.

4. Using the slide or transparency of world population growth, explain the nature of exponential growth. Something that grows exponentially grows at a constant percentage of the whole in a constant time period. It is useful to compare this idea to the interest collected at a bank or the doubling of a penny each day. It is also useful to think of exponential growth in terms of doubling time, or the time it takes a growing quantity to double in size. The following chart applies to any quantity:

Doubling Time Chart

GROWTH RATE % per year	DOUBLING TIME years
0.1	700
0.5	140
1.0	70
2.0	35
4.0	18
5.0	14
7.0	10
10.0	7

5. Hand out World Population Growth graph to students. Compare the world population data sheet to the graph they drew for the United States. In what ways are they similar? In what ways are they different?

Further Suggestions:

Get the population growth data of a town, country, or state and graph it. Compare your graph to the graphs of other students.

WORLD POPULATION GROWTH

(Graph adapted from The Population Reference Bureau)

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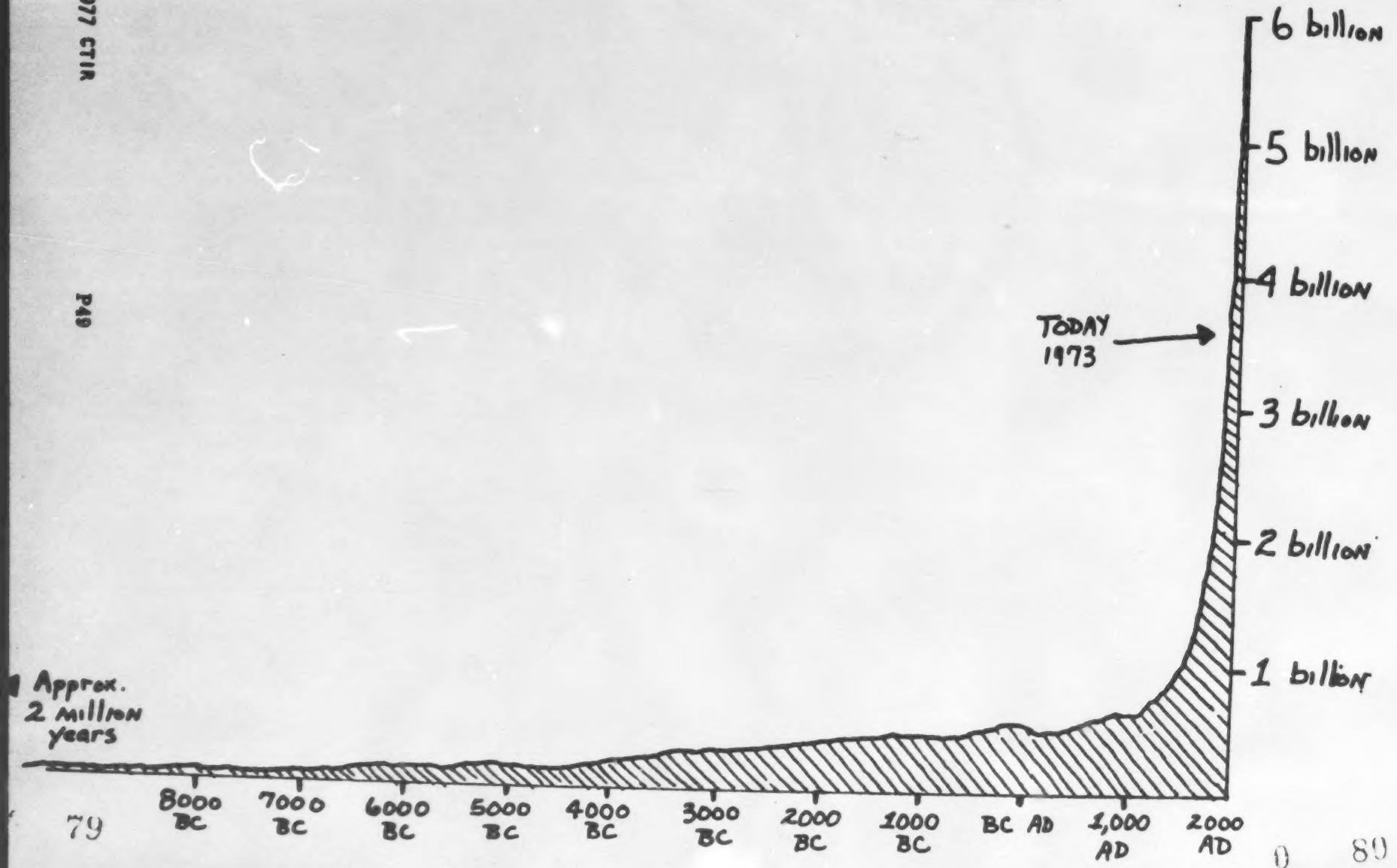

DATA FOR GRAPHS

United States Population

1800	5,300,000	1890	63,000,000
1810	7,200,000	1900	76,000,000
1820	9,600,000	1910	92,000,000
1830	12,900,000	1920	105,700,000
1840	17,000,000	1930	122,800,000
1850	23,200,000	1940	131,700,000
1860	31,400,000	1950	151,300,000
1870	39,400,000	1960	179,300,000
1880	50,200,000	1970	203,200,000

Data rounded off to nearest hundred thousand.

Data taken from World Almanac, 1973.

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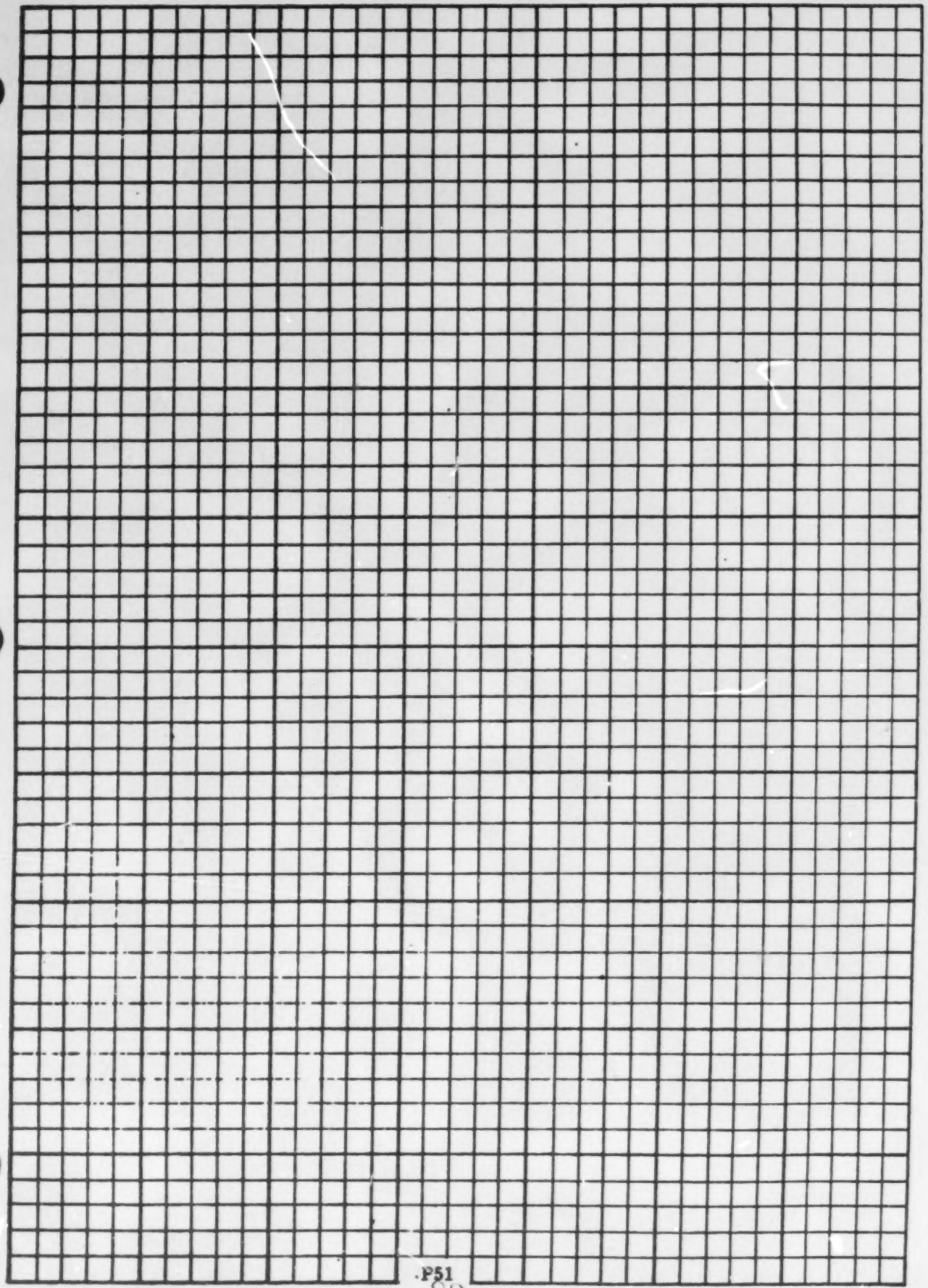

Title: MODELING POPULATION GROWTH*

Introduction: This exercise is designed to help the student understand exponential growth and doubling time when applied to human population. It explores human population growth in three situations: unrestricted exponential growth, institution of a limited birth control program, and a zero population growth plan. Additional information is given in the exercise to help the student develop attitudes regarding the effects of population growth on the human condition.

Objectives:

To demonstrate an understanding of exponential growth and doubling time.

To list several effects that exponential growth of the human population may have on the human condition.

To operate more effectively in a group situation.

Grade Level: 5-12

Time: Two to three class periods.

Materials: Student handout which includes instructions, charts for completion, additional information concerned with population growth, and questions for response. You will need 200 dice per group. One side of the dice should be blue, one side should be red, and one side should be black. The other three sides can be white or blank. Cubes can be obtained from math and science catalogs or cut for you in the shop.

Procedure:

1. Divide the class into groups of four to six. Do not explain the reason for the exercise to the students. Allow the students to reach their own conclusions. Hand out the student exercise sheets and the cans of dice. Go over the directions with the students and then let each group operate as much as possible on their own.

2. After the students have collected the data on their charts, they may transfer this information onto graphs if you wish.

3. In a class discussion, allow the groups to compare their results.

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*Adapted from an activity developed by John Christiansen and John Crouch.

4. During the class discussion, raise questions of the following nature:
   a. What did you learn from this exercise?
   b. Which population plan had the greatest appeal to you?
   c. Which population plan has operated during most of man's history?
   d. How often did your population double and how often do you predict it to double under each population plan?
   e. Comment on the following: "If we solve the population problem, we will have a chance at solving all other problems. If we don't solve the population problem, none of the others will matter." Do you agree with this statement? Why or why not?

MODELING POPULATION GROWTH

NAME _____

Introduction:

In this experiment you will use dice to model population growth. Each die represents a person. Each throw of the dice represents a year. A blue or a red represents the birth of a child, so each time one of them comes up, add a die to the population. If a black comes up, a death has occurred, so remove it from the population. Hence you are modeling a situation where the birth rate is twice the death rate. You also have a population growth rate of 1/6 or about 17%.

Procedure:

PART A: Unrestricted Exponential Growth

Put 6 ordinary dice into a container (Adam, Eve, Cain, Abel, Sally, and Alice). Shake the container and dump the contents out onto a smooth, hard floor. Remove and count all the black sides that appear. A "black" is analogous to a death. Record the number of deaths on the chart. Count up all the reds and blues that appear. Since they correspond to birth, add a die for each of them. Then fill in the required information in the chart. Repeat the above procedure until the total population exceeds 200 people.

PART B: The Effect of Instituting a Limited Birth Control Program

Return to the population you had after 10 years had passed. Put that many dice into the can. But now introduce a limited birth control program. This will be modeled by saying that a blue represents a birth, as before, and so does every other red. However, the remaining half of the red represent women who are on birth control and so a birth has been prevented. If an odd number of reds come up, round off in favor of a birth half of the time, and in favor of a reverted birth in the other half of the cases. Model this situation for the years 21 through 30. You have essentially cut the population growth rate from 17% to 8%.

PART C: The Zero Population Growth (ZPG) Plan

Return to the population you had after 10 years had passed. Put that many dice into the can. But now introduce a large scale birth control program. This will be modeled by saying that all the reds represent women using effective birth control techniques or women married to men using effective birth control techniques. Hence, a black represents a death, a blue represents a birth, and a red represents a prevented birth. Model this situation for the years 10-20.

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MODELING POPULATION GROWTH

Graphs and Conclusions:

PART A: Unrestricted Exponential Growth

Use your data to plot graphs of:

1. Population vs. Time (years)
   a. plot first on ordinary graph paper
   b. plot again on semi-log paper
2. Population Growth Rate vs. Time (years)
3. Population Growth Rate vs. population

Examine each graph and write a conclusion for each one

PART B: The Effect of Instituting a Limited Birth Control Program

Use your new data to plot graphs of:

1. Population vs. Time, 0-30 years. (ordinary graph paper)
2. Population vs. Time, 0-30 years. (semi-log graph paper)

Examine each graph, compare them to the Population vs. Time graphs in Part A, and then write a conclusion.

PART C: The Zero Population Growth (ZPG) Plan

Use your new data to plot graphs of:

1. Population vs. Time, 0-30 years. (ordinary graph paper)
2. Population vs. Time, 0-30 years. (semi-log graph paper)

Examine each graph, compare them to the Population vs. Time graphs in parts A and B, and then write a conclusion.

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Data:

PART A: Unrestricted Exponential Growth

Throw No. (Year)	Number of Births (N_b)	Number of Deaths (N_d)	Number of Dice (population)	GROWTH RATE	POPULATION GROWTH RATE $\frac{\Delta N}{\Delta t} = \frac{N_b - N_d}{1} = \frac{\text{people}}{\text{year}}$
0	-	-	6	0%	
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

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Data:

PART B: The Effect of Instituting a Limited Birth Control Program

Throw No. (year)	Number of Births (N_b)	Number of Deaths (N_d)	Number of Dice (population)		Population Growth Rate $\frac{\Delta N}{\Delta t} = \frac{N_b - N_d}{1} = \frac{\text{people}}{\text{year}}$
				%	
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Data:

PART C: The Zero Population Growth (ZPG) Plan

Throw No. (year)	Number of Births (N_b)	Number of Deaths (N_d)	Number of Dice (population)		Population Growth Rate $\frac{\Delta N}{\Delta t} = \frac{N_b - N_d}{1} = \frac{\text{people}}{\text{year}}$
				%	
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

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Title: Factors Affecting Overpopulation Other Than Birth (Mary Lou Mohler)

Introduction:

Changes in society, medical advances and laws, such as abortion laws, have affected population. Students need to be aware that the problem lies not only in the birth factor.

LESSON OBJECTIVES:

After completing this activity, the students should be able to:

1. Identify various factors that affect population.
2. Be aware that population is interrelated with many other areas of society.

MECHANICS:

Time: One class period.

ACTIVITY:

1. Students can work in groups and brainstorm factors in society that either affect population by increasing it or decreasing it.
2. If students have difficulty, you might suggest some to get them started (famine, improved medical techniques, education). Then discuss as a total group making a class composite.
3. The students might then make 2 lists from the one. The first list being factors man has no control over, the second being those factors man does have control over.

   The lists should include such items as:

   immigration
   flood
   famine
   drought
   disease
   medical advances
   abortion laws
   laws allowing life sustaining units to be shut off (or not)
   longer life span due to improved nutrition

Title: Factors Influencing Population Growth (Adapted from Intercom #78 by Richard Schweissing)

Introduction: Adults the world over--rich or poor, educated or illiterate, urban or rural--know where babies come from, and they know something about the personal consequences of having more children even if they have not considered the global implications in terms of population growth. In spite of massive family planning programs in some countries with rapid population growth, the change to smaller families is very slow or non-existent. For example, India began a massive family planning program over twenty years ago. The effort was expanded in 1965. India's birth rate, nevertheless, has shown only a very nominal decrease. Population experts, then, must begin to look for other reasons why high birth rates persist. This activity is designed to expose several factors which influence birth rates and possibly offer alternative plans which will encourage reduced family sizes.

Interdependence and perception/misperception are two concepts developed in this exercise. By looking at the need or desire for children from another cultural perspective it may be possible to explain why high birth rates persist in some countries. Also more effective solutions to population growth may be developed. If misperceptions of other's views persist, such solutions will not be possible. The group will also see the interdependent relationship between a whole gamut of factors which help determine birth rates.

This activity is data oriented and requires participants to draw conclusions about birthrates from data presented in a simple chart which considers such factors as religion, health, education, income and government programs.

The leader would find it useful to read some basic literature on attitudes of peasants in underdeveloped countries toward large families as a background to leading the discussion.

Lesson Objectives:

After completing this exercise each individual will be able to:

1. Read and understand a simple data chart about population.
2. List and explain why some factors used in the chart influence growth rates.
3. Suggest some policies governments might adopt that would indirectly encourage reduced population growth.
4. Suggest social changes within a country which could lead to reduced population growth.

Mechanics:

Teaching Time: One hour

Materials: Copies of the Growth Rate Chart (attached) for each individual.

Procedure:

1. **List six factors that influence population growth on chalkboard.** (See Handout)

   What effect might each have on a family's decision about the number of children to have?

2. **Rank order the factors according to their influence on population growth.**

3. **Pass out Growth Rate Chart. Discuss meanings of various headings. How could each effect growth? What factors seem most closely related to growth rate? Which seems to have little relationship? Does this agree with what you decided before seeing the chart?**

4. **Brainstorm what might be done to reduce population growth in the high growth countries. Best suggestions should include old-age programs, better medical care, education, etc. After these suggestions have been made, ask them to discuss which are most likely to be achieved and why.**

5. **Have students make a growth rate chart for their country.**

FACTORS INFLUENCING POPULATION GROWTH

1. **Religion**
2. **Education**
3. **Health Care**
4. **Family Income**
5. **Social Security Systems**
6. **Government policies encouraging discouraging population growth**
7. **Others you can think of**

Growth Rate Chart

Country	Growth Rate	Predominant Religion	Infant Mortality (per 1,000)	Percentage Illiterate	Per Capita Income	A National Social Security Program	Govt.-Sponsored Family-Planning Program
Brazil	2.8	Catholic	94	35	514	no	no
China	1.7		105	5	162	yes	yes
France	.9	Catholic	15	1	3,857	yes	no
India	2.4	Hindu	128	66	104	no	yes
Indonesia	2.6	Buddhist	125	43	86	no	yes
Israel	2.9*	Jewish	20	16	2,344	yes	no
Japan	1.3	Buddhist	12	1	2,700	yes	yes
Kenya	3.3	Christian	55	75	163	no	yes
Morroco	2.9	Moslem	103	80	276	no	yes
Mexico	3.2	Catholic	61	24	767	no	yes
USA	.9	Protestant	18	1	5,593	yes	no
USSR	1.0		24	1	2,412	yes	no
Venezuela	2.9	Catholic	50	19	1,285	no	yes

*Includes immigration.

Sources: UNESCO Courier, July/August 1974, pp. 47-62.
World Military and Social Expenditures 1974, pp. 22-27.
1975 World Population Data Sheet, Population Reference Bureau

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Reprinted from INTERCOM #78, "Teaching Interdependence: Exploring Global Challenges Through Data" (Center for War/Peace Studies, 1975), p. 10.

Title: **Free A Woman, Free A Nation (by Jacquelyn Johnson, Westminster Public Schools, and Barbara Miller, Aurora Public Schools)***

Introduction:

Students hypothesize and examine reasons for childbearing through the eyes of three different women immersed in three different cultures. After completing their hypothesis, students are given statements regarding childbearing in India, Nigeria, and the People's Republic of China. Students complete this activity by hypothesizing other opportunities for women and cultural attitudes toward child bearing in each respective culture.

Objectives:

1. Given role profiles of three women from three different cultures, students will hypothesize the reasons these women have for bearing children.

   Given statements from the three cultures these women represent, students will hypothesize about opportunities available to women in India, Nigeria and the People's Republic of China.

3. Students will draw relationships between attitudes toward childbearing and opportunities available for women in India, Nigeria, and the People's Republic of China.

Time: 2-3 days

Activity:

1. Begin by introducing the subject of childbearing. Why do people choose to have children? Poll some student responses.

2. Pass out Raksha. Have students answer questions at the end. Discuss.

3. The accompanying teacher handouts can be made into overheads and shared with the students after they have made their own lists.

4. Repeat this process with Kawe and Mieling.

*Revised 1980 - C. Stonebraker

Teacher Resource: Attitudes Toward Childbearing in India*

1. More children can earn for the family. The father can also rest if there are more children to earn for him.

2. A son is important for the family's name. He keeps the "door" open. Many people do not stop having children until a boy comes. At least one son is necessary to keep the family name going.

3. If there is only one son, then he has the whole economic burden...supporting the family and paying for all the ceremonies such as his sisters' weddings.

4. If there are only two children, the boy and a girl, and the boy dies, the mother is considered barren.

5. The advantage of having many sons is that they will have different occupations and earn more.

6. Having many sons means more fame for the family. This way one's own name remains at the top.

7. When there are five or six children, a parent can have a peaceful life in old age. Mothers can depend on their sons because they can rightfully claim anything from them.

8. The biggest advantage of the large family is that when all the brothers unite nobody dares bother them. They can live with power in their hands.

9. If a woman has many children, others will look up to her. When someone asks a woman if she has children, she can say proudly: "I have many children!"

10. Suppose a woman has a daughter and a son. What happens if God takes away one child? If her son dies, then she has only one child to look after her. If a mother has five children, then at least two or three of the children may live.

* — Indiana University, Population Education Project, 1973.

Teacher Resource: Attitudes Toward Childbearing in Nigeria*

The first and foremost desire of a married couple is for children; having children is regarded as the chief aim of all marriages. Childlessness therefore is regarded as a disease. A woman who can't have children is treated almost as an outcast and has little influence among her people. She is everywhere despised and distrusted. If she cannot have children, everyone is certain it is her fault. The ancestral spirits will not insert a soul in her womb or do not want to be reincarnated in her. Childlessness often leads to divorce or polygamy. Only in the large cities in Nigeria do some people among high income groups believe there is a need to limit family size. Parents want children for many reasons and mothers in particular cherish the idea in spite of the ordeal of childbearing.

Reasons for having Children in Nigeria

1. Children are the yardstick for measuring the success of marriage.

2. Children are a source of social prestige. Parents who have many children are greatly respected, and are addressed by special titles.

3. Children prove their father's manhood and mother's womanhood and remove the stigma of barrenness. Children prevent accusations of impotence and witchcraft.

4. Children are of economic value. They are valued for their help on the farm and in the home. In the olden days they could be pawned to pay off a debt.

5. Children are a great investment. They support the parents in old age and are their heirs forever. Children perpetuate the family and the family name, and ensure decent burial and fame for their parents.

6. Since one is sent into the world to be fruitful and multiply, a large family is evidence that one is loved by the gods.

7. Without children, marriage would break up and even if it continues, the couple would live unhappily.

8. When parents reach old age, their children are expected to clothe and feed them and to give them comfort. In this sense, children are a sure means of social security, pride, and happiness to parents.

9. Most families have their traditional occupations and parents always wish the skills of their trades to be passed on to their children.

10. "It is better to accumulate children than to amass wealth", is a common saying among Nigerian people.

*Excerpted from Ngwobia Uda, Growing Up in Nigerian Culture, University of Ibadan, Institute of Education, Occasional Publication No. 6, 1966, pp. 35-36.

Teacher Resource: Attitudes Toward Childbearing in China*

1. Women are encouraged to marry at a later age, to decrease the number of years during which they could potentially have children.

2. In China today, women make the decision as to how many children they will have. Family planning represents the demands of the many women who want to be freed of the burden of many children in order to be able to work for development of the country.

3. The policy of limiting family size is considered an important decision-making area by the government, in order to promote a better life for the Chinese people. Each individual should have as good a life as possible. Quality of life—rather than quantity—is important.

4. Women must be able to see positive advantages in limiting the number of children they have. Education is most important. For example, if women realize that it is better to have fewer and healthier children, and also have more time to study and free themselves, this is a good reason to limit the number of children they have.

5. Women teach one another about family planning, going from village to village. They even decide how many children should be born on a particular street, or in their village, and then determine how many women can have children that year. Many women volunteer to wait a year to have a child.

6. In China, people are much closer than in many other countries. Children do not feel strange when around people other than their parents. Many people feel as though the children of another are their own.

7. In China, children may live apart from their families for short periods of time while attending school. Yet family ties remain closely-knit, and children begin at a very young age to interact with people.

*Compiled by Anna Chung, Center for Teaching International Relations

RAKSHA

Raksha is a real woman who lives near Bombay, India.

My name is Raksha and I live in a small village not far from Bombay. I think I am about 25 years old, but I am not sure. I have five children and expect my sixth soon. I have actually given birth to eight children. I hope this one lives past the difficult first month. I will be glad when my pregnancy ends, since I have been weak and ill. The doctor feels that I should not have more children since I am not well, but in our country it is important to have a male child since that is the only way the man's family continues. My mother-in-law lives with me, and she feels that I should have as many children as God gives me. I will do as she says. After all, it is she who has power. My parents paid a dowry for me and arranged my marriage, too, and I must not disappoint them.

Some women in my country hold jobs, and a few go to school. Women work in factories, hospitals, and offices, something they never would have done 20 years ago. The female literacy rate is still only 18.9%, however.

Answer the following:

1. **Explain the term literacy rate.**
2. **Give some reasons to explain why Raksha does not know her age.**
3. **What is an arranged marriage?**
4. **Explain what a dowry is.**
5. **Give some reasons why the female literacy rate is so low.**
6. **Why does Raksha's mother-in-law have power?**
7. **Make a list of reasons why it is necessary for Raksha to have several children.**
8. **What other jobs could Raksha do besides being a mother and wife?**
9. **Why doesn't she do other jobs?**
10. **Is there a relationship or connection between Raksha's opportunities for jobs and her desire to have children?**

KAWE

I am Kawe, and I live in a northern farming village of my modernizing country. We grow oil palms and farm for a living.

I am now thirty-five years old. I have been married to my husband for 20 years. I am not the only wife of my husband. Even before he married me he already had two wives. I would have been the third except that he divorced the second wife for not bearing a child during the first two years of their marriage. In our society a childless woman is a person to be despised because the spirits did not find her a fitting person and did not wish to be incarnated in her. Both my husband's first wife and I are successful wives, for we have borne children, including sons. Our children can help us farm, can support us in our old age, and can bury us when we die.

My son is going to school to learn to read and write. He needs these skills to become an important person in our village. None of my girls go to school, nor, I think, have any girls from our village. They need to learn skills to help their husbands-to-be on their farms. Some people say that if the girls get educated they might get bad ideas and elope.

Overall, I try to keep my husband happy, provide him with children, who are more precious than wealth to our people, and make him satisfied with the "bride price" he paid for me.

1. How old was Kawe when she was married?
2. What is a "Bride Price"?
3. Think of reasons why girls are not educated in Kawe's Nigerian village.
4. What happens to Kawe's husband's second wife?
5. List reasons why Kawe wants to have children.
6. Does Kawe have an education?
7. What else could Kawe be, other than a wife and mother?
8. What relationship is there between Kawe's choices and her attitudes toward childbearing?
9. Who has more choices Kawe or Raksha?
10. Who is more likely to have more children? Explain.

MEI-LING

My name is Mei-ling. Before the revolution of 1949, in my country women were treated poorly. Husbands beat wives, peasants beat children, and mothers-in-law beat their sons' wives. Peasant women worked hard in the fields, or as servants to the wealthy; upper class women did no manual work, but concentrated instead on their families and the raising of children. Some upper class women went to universities, but the main purpose of all women was to produce male heirs to continue the husband's name and control his property. Women were denied education and were supposed to stay at home and be subordinate, one reaon for the painful practice of binding the feet of girls.

With the revolution of 1949 came many changes in the status and roles of women. In 1950, the first Marriage Law was passed in my country, by which arranged marriages were abolished and widows were given the right to remarry. Women are no longer "commodities" of sorts, but have attained full economic and legal equality. Women have taken the lead in family planning programs, and have full rights in determining the size of their families in accord with state policy. Women work together in family planning at the village and neighborhood levels. As an example, women on a particular street in a village or rural area decide together the number of children which can be reasonably added to the population for that year. They then determine from this how many will be able to have a child. Many women volunteer to wait a year before having a child.

This method has been successful. This can be proved by the fact that the annual population growth rate has remained stable in the period 1973-75, at 1.7 rate of growth. The key to family planning in my country is persuasion rather than coercion. Through education, women can see positive advantages in practicing family planning. It is more advantageous, for example, to have fewer and healthier children, and thus be free to contribute to the buildilng of the nation, than to have a very large family.

I myself, am a full-time worker. I was a medical student before marriage, and worked as a nurse before entering medical school. I did not marry until the age of 25, feeling it important to complete schooling and begin my profession. The state favors late marriage, as it has aided in reducing the population and encouraging young people to work and serve their country. I have 3 children, who attend school six days a week, and eat their meals in state dining halls. Children are often separated from their families for periods of time, and learn early to interact with other people. Yet family ties remain close despite separations. My three-year old girl lives in a full-time kindergarten, but I see her on Sundays. It is good that the state cares for her, since we women need to be free to work for the revolution. I spent a year in the countryside two years ago giving medical care to the peasants. I did not see my family during this year; my children were proud of my service to the peasants. Since 1949, the state has greatly encouraged me in my profession, as it has encouraged women in general to contribute to the welfare of the nation.

Me-ling is also a real woman. Her home is the People's Republic of China.

Answer the following:

1. What was life like in China before the 1949 revolution?
2. How has life changed?
3. How is family planning practiced in China?
4. Why did Mei-ling marry so late?
5. What is her children's life like?
6. What benefits and disadvantages are there to full-time schools for children?
7. Compare Mei-ling to Kawe and Raksha. What are the similarities and differences?
8. What opportunities are open to Mei-ling and other Chinese women?
9. How do their opportunities relate to their decisions about childbearing?

Title: ATTITUDES TOWARD CHILDBEARING*

Introduction: Many decisions regarding family size are influenced by societal pressures and norms. Other factors include the economic circumstances and career attitudes of the prospective parents. This activity is designed to allow an examination of some of the influences that prevail in the decision to bear children. If people recognize the influence of societal pressures and the need to examine parental vs. career roles, they will be better prepared to make real choices about their own family size.

This activity is designed to guide individuals in their own expectations regarding family size in the context of the perception of what the society expects. By identifying perceptions that are not often articulated, they will be more aware of factors pressuring their own decisions.

Utilizing an individual survey dealing with expectations of marriage relationships and childbearing, the group is directed to examine reasons for the expectations that surface in a composite of the answers of individual group members. The activity is then focused on some of the reasons people have children through the use of a scenario about one couple's plans. The activity culminates with a values discussion of the reasons people have children.

Objectives:

To suggest various personal actions through which students can influence population changes.

To identify factors in American society that influence the types of population-related decisions a person makes.

To identify students' own long- and short-range values and preferences as they relate to population issues.

To suggest several ways of altering existing population trends so that the outcomes are consistent with one's own values and those of society.

To assimilate data from individual responses into a useful composite form.

Time: One class period

Materials: Individual copies of "Survey: Marriage & Childbearing," and "Case Study: Are Boys Better?"; Chalkboard or overhead projector and transparency of the survey.

Procedure:

1. Each student should be given a copy of "Survey: Marriage and Childbearing" to complete, preferably prior to the beginning of the session.

*Adapted by Richard Schweissing.

2. The session itself should be opened with some basic introduction to the ideas that many of our attitudes regarding marriage and childbearing are the product of the society in which we live. Therefore, the purpose of the session is to identify those attitudes commonly held by the group and then look for the reasons why they exist. The group should be urged to approach the discussion with an open mind, prepared to accept the possibility that some commonly accepted values may no longer hold any valid purpose for society.

3. (10 minutes.) Tabulate the results of the survey. This can be done in a number of ways. If the survey was taken early, the papers may be collected and tabulated in advance. If they are tabulated at the beginning of the class session, it can be done by a show of hands. Unless the group is fairly open, it may be wise to exchange papers randomly so anonymity may be maintained. Be sure that male and female responses are tabulated separately.

4. (20 minutes.) With the group, identify those responses that are similar. It is very likely that many of the answers will reflect common plans for marriage and childbearing. Call the attention of the group to differences (if they exist) between male and female responses. After common answers and differences based on sex have been defined, ask the group to explain reasons for those views that are held in common and see if explanations can be offered for the differences.

   Mentioned or not, tradition will be reflected in many answers. Marriage age for the majority falls within a common age for the whole society. Some probing might reveal that individual expectations reflect the actual experience of the parents. Family size also follows some common patterns. However, trends here may be away from the pattern of previous generations.

   Differences expressed between males and females may be reflected in the desire of more women to have careers. It may also reflect the economic perceptions held by many of the need for both members of a marriage to work.

   Another area to consider is the correlation between the expectations for a woman to work and the number of children expected. If the results in fact warrant such a response, it would be important to raise the point of expendability of children in a modern industrial society. The group may explore the growing attitudes related to the idea that children are now more a product of choice than of either need or chance.

5. (15 minutes.) To complete the discussion, the group should focus some attention on the reasons people have children. A springboard for this phase of the discussion is the "Case Study: Are Boys Better?" Questions to raise following the case study:
   a. Is Paul and Freda's reason for wanting a boy a common one? Is it valid?
   b. What are some other reasons for wanting children, or one of a particular sex?
   c. Are there any alternatives to these goals?

6. Once the discussion is over, a repeat of the original survey will show what, if any, attitudes changed because of the discussion.

SURVEY: MARRIAGE AND CHILDBEARING

From OPTIONS: A Study Guide to Population and the American Future, The Population Reference Bureau, 1973.

1. Female Male

2. Do you plan to marry? Yes No

3. If yes, at what age do you plan to marry? Age _____

4. If female and you plan to marry, do you plan to work after marriage? Yes No

5. If male and you plan to marry, would you like your wife to work after marriage? Yes No

6. If female how long will you work? If male, how long should your wife work after marriage? Years

7. If you plan to have children, at what age would you expect to have your first child? Age _____

8. How many children do you want to have? No. _____

9. How many children do you *expect* to have? No _____

10. At what age would you expect to complete your childbearing? Age _____

Do you agree or disagree with the following statements:

	Agree	Disagree
11. Part of the fulfillment of everyone's life is in marriage.		
12. Part of the fulfillment of everyone's life is in having children		
13. A childless or a single-child family may have as fulfilling experiences as other families.		
14. If a couple has the number of children they want, but all are of one sex, they should keep trying for a baby of the other sex.		
15. All American couples should have two children in the interests of stopping population growth		
16. Woman's place is in the home		
17. After marriage and childrearing, women should continue working.		
18. Because most women marry and leave work when children are born, minor forms of job and pay discrimination must be expected		
19. Unmarried women who are in their 40's and 50's are lonelier than unmarried men of the same age.		

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Case Study: Are Boys Better?

Paul and Freda Wilson are a young married couple in their early twenties. They have two little girls aged four and six. They have read in news magazines that if the present world population growth of 2 percent continues for another 650 years, there will be one person for every square foot of surface on the entire earth. Paul and Freda have always supported the "zero population growth" idea. They also realize that to reach zero population growth families, on the average, would have two children.

Paul and Freda also want a son to carry on the "Wilson tradition" on the football field at Calumet College in a nearby town where Paul and his father were star halfbacks in their college days.

Questions:

1. **Why do you think Paul and Freda want a son so badly?**
2. **Do you think it really matters what they decide? Why or why not?**
3. **What do they need to consider in making their decision?**
4. **Can you think of one sure way of having a boy in the family without Freda bearing another baby?**
5. **What do you think Paul and Freda should do? Why?**

Photo by Ken Heyman

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Title: POPULATION CONTROL: WHERE DO YOU STAND?*

Introduction: A summary of population control steps are presented. The statements represent a wide variety of programs, some enlarging the freedoms of individuals and others greatly restricting individual freedoms. Students are asked to identify those steps they feel are necessary now to curb population growth.

Objectives:

Given a number of alternatives related to population growth, students will categorize them according to steps which enlarge both individual and societal freedoms, steps in which an individual gives up freedoms for the betterment of society and steps which greatly limit the freedom of individuals.

To articulate relationships between population control programs and amount of individual and societal freedoms.

To articulate which steps are most urgent and which will be necessary in the future if growth rates continue.

To articulate how individual choices and actions can influence population growth (i.e., the student will see himself as a population actor).

Time: One to two days

Materials: Student card sort; and "Population Control: Where Do You Stand?"

Procedure:

1. Begin with a discussion of population control. Is it necessary now? How do students view population growth--as a problem or a crisis?

2. Introduce the following categories for steps in population control:
   a. Population control steps which enlarge individual freedoms and the freedom of society.
   b. Population control steps in which the individual gives up freedoms for the betterment of society.
   c. Population control steps which greatly limit individual freedom (i.e., totalitarian controls).

   Poll student responses for examples of population control steps in each category.

3. Divide the class into groups of four to five and assign the card sort activity. Students should read the alternatives and categorize each one into one of the three categories outlined above. They should also identify the reasons for their choices and be prepared to defend why they placed each population control step in a particular category. Encourage students to develop their own cards for this activity, also.

*Developed by Jacquelyn Johnson.

4. Allow time for groups to compare their results with one another. Class results should resemble the following:

   Group I: Education Programs; Equality for Women; Social Security; Ability to choose sex of unborn child; Abortion.

   Group II: Postponment of Marriage; Incentives and rewards; Birth Control.

   Group III: Penalties for large families; licenses to have children; sterilization of parents.

5. Share the above categorization with the class. Poll the students for agreement and disagreement to this categorization. Ask students to share their alternative "write-in" population steps with the rest of the class.

6. Next, instruct groups to categorize the alternatives according to those they feel are necessary now to curb population growth and those which will be necessary in the future if present growth rates continue.

7. Ask students which alternatives they <u>themselves</u> would be willing to adopt. Have they changed their opinions related to family size as a result of these activities? If so, in what way?

Directions: Cut out each alternative and place in the appropriate category on the next page. Be able to defend your choices.	EDUCATIONAL PROGRAMS Making people aware of our population growth problem might help to solve it.	ABORTIONS If safe and legal, abortions were available on demand, population growth might be limited.
BIRTH CONTROL Make birth control means available to anyone who wants it. The effect will be to curb population growth.	STERILIZATION After two children, one or both parents will be sterilized to halt population growth.	EQUALITY FOR WOMEN Equalizing opportunities for women will provide them with other roles to fulfill and they'll have fewer children.
POSTPONEMENT OF MARRIAGE Raise the age of consent so people would marry later in life, thus reducing the number of child-bearing years.	SEVERE PENALITIES FOR LARGE FAMILIES People will be fined or heavily taxed for any children beyond the legal limit of two.	INCENTIVES AND REWARDS FOR SMALL FAMILIES A reward system will be set up for people who limit their family size. They would pay less in taxes.
CHOOSING THE SEX OF AN UNBORN CHILD People often continue to have children until they get the boy or girl they want. Families could choose the sex of their children, thereby limiting their size.	SOCIAL SECURITY IN OLD AGE If people were financially cared for in old age, then they wouldn't need large families and families would choose to limit their size.	LICENSES TO HAVE CHILDREN People must meet certain qualifications to get a legal license to have children.

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CARD SORT: POPULATION CONTROL: WHERE DO YOU STAND?

CATEGORY I: Population control steps which <u>enlarge</u> individual freedoms and the freedom of our whole society.

CATEGORY II: Population control steps in which an individual <u>gives up</u> freedoms for the betterment of his/her society.

CATEGORY III: Population control steps which greatly <u>limit</u> individual freedoms.

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Title: VALUES AND POPULATION: FOUR ACTIVITIES, by Nancy Miani

Introduction:

The Values Clarification Process. Values clarification is a simply-outlined process by which persons can become aware of their own values and beliefs and move in the direction of making their actions more consistent with their values. Developed by professional educators, values clarification has since 1966 achieved great popularity among classroom teachers who report it both effective and popular. The process is outlined as follows:

I. Choosing Values
   1. Values must be freely chosen.
   2. Values must be chosen from among alternatives.
   3. There must be thoughtful consideration of the consequences of each alternative.

II. Prizing Values
   4. The value must be prized and cherished.
   5. We must be willing to publicly proclaim our values.

III. Acting on Values
   6. Acting on values.
   7. True values will be acted upon repeatedly.[1]

Although comprising a simple outline, the process --as is apparent on examination-- is not at all simple to effect. It is obvious that classroom application of the values clarification process is dependent on very special leadership on the part of the teacher --an adult who can build the trust necessary to allow defenses to fall, who can permit free choosing of values without imposing one's own values, however slightly. The teacher, in short, has to practice what is preached, or the whole technique will likely dissolve into so many empty gimmicky exercises. The teacher has to drop her or his own defenses, be willing to admit his or her own values and provide a genuine model of a productive, self-directed adult.

Lesson Objectives:

-- To let participants consider global issues from the locus of their own personal values system

-- To give participants practice in determining and vocalizing decisions based on personal values

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[1] Sidney B. Simon and Jay Clark, MORE VALUES CLARIFICATION: STRATEGIES FOR THE CLASSROOM (San Diego, CA: Pennant Press, 1975), pp. 31-35.

Mechanics:

Teaching Time: 1 or 2 class periods
Materials. pencil and paper

Activities:

VALUES WHIP / POPULATION

(Adapted from Sidney B. Simon et al., VALUES CLARIFICATION, Hart Publishing Co., New York, 1972, pp. 130-131). The Values Whip is a strategy readily adapted to many lessons. It provides a simple and quick means for members of a group to see how others in the group respond to certain issues. The group leader presents the group with a question to consider for a few seconds. Then the leader "whips" around the group soliciting brief answers to the question. Of course, any student may choose to "pass."

How many children do you plan to have?
Do you believe the world has a population problem?
Are you in favor of setting the size of families by law?
How many family members should such a law allow?
_____?
_____?

TWENTY THINGS YOU LOVE TO DO

Participants each make a list of twenty things they love to do. When lists are complete, participants should place a P next to items on their list which would be more difficult or less pleasant to do if the world population were double what it is today. Then participants should complete this statement: "I have become more aware that . . . ."

POPULATION EXPLOSION

Participants write down three statements about the "population explosion," leaving spaces between the statements. Follow each statement with a phrase beginning "I see that I need to . . . ." Form groups of 3-5 and compare statements.

IF YOU'RE NOT PART OF THE SOLUTION YOU'RE PART OF THE PROBLEM

Have the group brainstorm ways in which individuals can in small ways help to alleviate the world population problem. Make a grid:

1. _____	WILL TRY	WILL CONSIDER	WON'T TRY
2. _____			
etc.			

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TITLE: Leading Your Country (Evaluation)

Introduction:

Now that students have completed the population portion of the unit they need to state their ideas on population control.

Objective:

1. Students will express their opinions about population control in written form.

2. Students will practice writing skills.

Activity:

1. Students are told they are the leader of their country. Their country's major concern is population. The new leader is giving a speech on national T.V. to present a new plan for population control. Write the leader's speech.

2. Students may present their speeches to the class at the teacher's discretion.

Developed by P. Heist and C. Stonebraker - 1980

Food

Title: Word Association (By Sharon Willsea)

Introduction:

People realize how important food is to them. People, however, do not put the same values on food. Some realize its importance for its contribution to life; others are concerned with its nutritional value; still others are concerned with its taste and social value, i.e., getting together with friends to eat, etc.

LESSON OBJECTIVES:

1. After completing this activity students should realize that food represents many different aspects of life to many different people.

MECHANICS:

Time: Less than one class period
Materials: None

ACTIVITY:

This is a brainstorming activity to do with students. Put the list of words, one at a time, on the board. Have students react to the word by stating the first word that comes to mind. Discuss the differences in answers and why students stated the answers they did.

1. food
2. hamburger
3. chow mein
4. pepsi
5. rice
6. bread
7. pizza
8. potatoes
9. carrots
10. malt
11. tortillas
12. Milky Way

Title: Personal Food Survey (by Gary Smith and George Otero)

Introduction: This simple survey is designed to increase participant awareness of the many variables involved in our eating habits and patterns. After answering a few questions concerning personal eating routines, participants analyze their responses using questions that probe the motivations and determinates behind eating patterns.

Lesson Objectives:

To increase knowledge about the possible motives and determinants behind their own eating habits and patterns.

Mechanics:

Time: 1 class period

Materials: Duplicate copies of the Personal Food Survey for each participant in the group.

Activity:

1. Tell the group that you are handing out a short survey on personal eating habits which will be used as the basis for a discussion of eating patterns in this country. Have each individual answer the survey. This can be done anonymously if people would answer more honestly thereby.
2. After students have completed the survey, discuss the questions at the end of the survey with the group.
3. Have the participants consider one change in our society that would have an important and/or dramatic effect on their eating patterns. Would they be pleased with the change? If so, how could the change come about?

PERSONAL FOOD SURVEY

1. What are three of your favorite foods? _____

   _____

2. How many meals a week do you eat outside of your home?

   1 2 3 4 5 6 7 8 9 10 or more

3. Listed below are reasons people give for eating. Place an X next to any reason you feel you have never had to use to eat. Place an O next to the three most frequent reasons you use to explain eating habits. Place a check next to the two reasons you think should be used to justify our eating habits.

   -----survival
   -----enjoyment
   -----oral gratification
   -----habit
   -----social company
   -----business
   -----comfort
   -----other

4. How often did you eat yesterday? (Count any time you ate something.)

   -----not at all
   -----once
   -----twice
   -----three times
   -----four times
   -----five times
   -----six times
   -----seven times or more

5. Have you ever been on a diet for a week or more? Yes _____ No _____

6. Which age group applies to you?

____ 1-10	____ 19-25	____ 51-60
____ 11-13	____ 26-36	____ 61-70
____ 14-18	____ 37-50	____ 71-90
		____ 90-

Questions:

1. Which of the above reasons for eating could be eliminated or reduced?
2. Could you cut down on the number of times you eat each day? Do you think you should cut down?
3. How would you explain the choice of your three favorite foods?

Title: "The Great American Steak Religion" (by Loyal Darr, Denver Public Schools)

Introduction: The vast majority of the people of the United States are steak/meat eaters. It seems to be a distinct part of the American culture -- eating meat. In fact many Americans not only like meat but they "religiously" believe or at least accept "thinking" about meat that is actually myth rather than fact. Many Americans feel that because we eat a lot of meat that it is the best food for us by just about any standard that one wants to apply. Meat in fact is an excellent food by many standards but it is not the "everything" to everybody that so many Americans might think. One of the purposes of this exercise is to place steak/meat as a diet item in proper perspective and to encourage students to at least think about alternate foods to steak/meat as a nutritious source of food.

In this simple exercise students are given eight statements about steak/meat and asked to respond if they are fact or myth. Each of the statements repeat a common myth held by many Americans to be a fact about steak/meat. After students make and defend/debate their responses, then the fact about each myth is given to them.

Lesson Objectives:

After completing this exercise, the student should be able to

1. Distinguish fact from myth when given selected statements about steak/meat and plant foods.
2. Indicate that there are foods other than steak/meat which are nutritious.
3. Discuss ways in which Americans can be less wasteful when it comes to the choice of nutritious foods and adequate diets.

Mechanics:

Time: 1 class period

Materials: Student handouts entitled "Fact or Myth" and "Fact."

Activity:

1. Advance preparation: Duplicate the student handouts "Fact or Myth" and "Fact," one each for each student--make a few additional copies.
2. Pass out the student handout, "Fact or Myth."
3. Ask each pupil to mark each of the statements on the handout myth (if it is false) and fact (if it is true). 5-10 minutes
4. Divide the class into groups of 4-6. Ask each group to elect a chairperson. Give the chairperson of each group a blank handout, "Fact or Myth."
5. Assign each group to discuss and come to a consensus on a group completed handout. (10-15 minutes)

6. Have each chairperson report on his group's responses. (The teacher may want to organize the responses on the chalkboard.)

7. Pass out the student handout, "Fact." Debrief the activity by discussing the general role of steak/meat in the American diet and the fact that we as a people are probably quite wasteful in this regard and that there are other foods which are just as nutritious, if not more so, as steak/meat. (10-15 minutes)

Further Suggestions: Discuss whether or not as a nation we should export more steak/meat and eat more kinds of other foods. Would this help the world hunger/food situation? If so, why and how? If not, why not? Discuss other ways our eating habits--diets, etc., might be related to world hunger. What should be our relationship to the "hungry" nations of the world?

"Fact or Myth"

_____ Meat contains more protein than any other food.

_____ Eating lots of meat is the only way to get enough protein.

_____ Meat is the sole source of certain essential vitamins and minerals.

_____ Meat has the highest quality protein of any food.

_____ Because plant protein lacks certain essential amino acids, it can never equal the quality of meat protein.

_____ Plant-centered diets are dull.

_____ Plant foods contain a lot of carbohydrates and are therefore more fattening than meat.

_____ Our meat-centered diet is more nutritious than the poor world's.

"Fact"*

Myth: Meat contains more protein than any other food.

Fact: About 25 percent of meat is protein. On a 0 to 50 percent scale of protein content in various foods, meat ranks in the middle, together with some beans, cheese, fish, and nuts.

Myth: Eating lots of meat is the only way to get enough protein.

Fact: The "average" American eats almost twice the protein his body can actually use. Most Americans could completely eliminate meat, fish, and poultry from their diets -- and still get almost the recommended daily allowance of protein (fifty-three grams) from other protein-rich foods.

Myth: Meat is the sole source of certain essential vitamins and minerals.

Fact: There are eleven important vitamins and minerals. Non-meat foods provide more than half our intake of eight of them. Meat is not the sole source of any of the others.

Myth: Meat has the highest quality protein of any food.

Fact: "Quality" is an unscientific term. The proper standard is usability: how much of the protein eaten is actually used by the body. The usability of egg and milk protein exceeds that of meat.

Myth: Because plant protein lacks certain essential amino acids, it can never equal the quality of meat protein.

Fact: All plant foods commonly eaten as sources of protein contain all eight essential amino acids. Plant proteins do have deficiencies in their amino acid patterns that make them generally less usable by the body than animal protein. However, by combining plant foods, you can balance their amino acid patterns and create protein usability equal to that of meat.

Myth: Plant-centered diets are dull.

Fact: There are basically five different kinds of meat and poultry--compared with about fifty kinds of commonly eaten vegetables, twenty-four kinds of peas, beans, and lentils, twenty fruits, twelve nuts, and nine grains. Plants obviously have a greater variety of flavor, texture, and color.

Myth: Plant foods contain a lot of carbohydrates and are therefore more fattening than meat.

Fact: Ounce to ounce, most plant foods have either about the same calories (as in bread) that meats do, or considerably fewer. Many fruits have one-third the calories, cooked beans have one-half, and many green vegetables have one-eighth the calories that meats contain.

Myth: Our meat-centered diet is more nutritious than the poor world's.

Fact: In fact, we eat too much of the wrong foods. While consuming 50 percent more protein (much of it wasted) than the average Indian does, we eat four times as much sugar, eight times as much fat. If we ate more plant our diet might actually be improved.

*taken from The Development and Allocation of Scarce World Resources (Document No. 94-95) Washington D.C.: U.S. Government Printing Office, 1975. (pp. 167-168, "The Great American Steak Religion")

Title: "Junk Food Junkie" by Debbie Stein

INTRODUCTION:

A popular song provides the basis for this activity. Students are asked to analyze, through music, American attitudes and eating habits and then compare them with other cultures they have studied.

OBJECTIVES:

1. Students will use familiar materials to obtain information.
2. Students will learn to listen for a purpose.
3. Students will sort and list ideas relevant to a particular topic.

MATERIALS:

One copy of the song "Junk Food Junkie" by Debbie Stein

ACTIVITY:

1. Play the record once and ask the students to write down as many items as possible which show how Americans feel about food and what types of food they eat.
2. Discuss the lists (you may need to play the record a second time) and formulate a list of attitudes held by Americans toward food and a list of foods that are mentioned.
3. Compare the food lists with common foods in other countries and with foods needed for good nutrition, discuss the following questions: Why do we like these foods? Why don't other people like them? Could a record like this be made in Nigeria or Brazil?
4. Have students write a review of the record including a statement about what it says about our culture.

Title: Food Wastes in School (Mary Lou Mohler)

Introduction:

A quick observation in many school lunchrooms would show a great amount of food wastes. This activity should create an awareness of the amount of waste in the student's own school and serve as a springboard for some possible solutions.

LESSON OBJECTIVES:

1. The students should be able to offer evidence that there is food waste in their school.

2. The students should be able to identify some possible causes and suggest possible solutions.

NOTE: This activity is not designed to criti-ize school lunches. Care should be taken so that emphasis is not placed on the lunch itself but rather on the waste and ways to avoid it.

MECHANICS:

Time: One lunch period for observation or interviews.
One period for tabulation of results and discussion.

It is suggested that the school cook be made aware of the activity and its purpose.

ACTIVITY:

1. There are various ways of observing food waste. One way is to station students at the waste depository. One can count desserts or fruit thrown away, one can count main courses, one milk, etc. It should be decided before the count whether to include half portions or only full portions thrown away.

2. A lunch count can be obtained from the cook. She or he can also give average serving size in weight. From this, the students can tabulate total amount of food wasted. With the help of the cook, they can also tabulate average waste in dollars.

3. The results can be discussed in class with emphasis placed on suggested ways to avoid waste. Students may suggest buying ala carte. At this point, it may be helpful to invite the cook to speak to the class about Federal regulations. These regulations involve serving Type A lunches.

ADDITIONAL SUGGESTIONS:

Instead of a food count, students may conduct a survey of the student body. The purpose would be to determine amount of food waste and some possible causes. The survey should be written by the students, the questions depending on individual interests and situations.

Title: Food Advertisements: True or False (By Sharon Willsea)

Introduction:

In American society, we are influenced as to our food preference by many different aspects of advertising. Some advertisements focus on economy, some on nutritional values, some on quantity and some on quality.

LESSON OBJECTIVES:

1. Students should be aware that food advertisements are not always based on the same criteria.

2. Students should be aware that when they are comparing products, they should be using comparable criteria; ex. economical value, quantity, nutrition, quality.

MECHANICS:

Time: Whatever you would allot
Materials: A bulletin board

ACTIVITY:

Have students divide bulletin board into 4 sections labeling each one, one of the following: QUANTITY, QUALITY, ECONOMY, NUTRITION.

Students should bring in printed advertisements dealing with food. The advertisements should be judged as to which criteria the advertiser is using. The advertisement should be placed in the proper space on the bulletin board.

Title: Calorie Counting (by George Otero and Richard Schweissing)

Introduction: As world food supplies diminish, it becomes increasingly important that people in more affluent societies evaluate their own eating patterns. They are, after all, the one group of people most able to adjust their patterns for the common good and they are also perhaps the only ones left with free choice to do so.

This activity develops aspects of the concept perception/misperception. A common phrase, "I'm starving!", reflects some very real, if not accurate, perceptions of our own conditions--this activity is likely to expose the myths related to them.

This activity requires each individual to evaluate his caloric intake for one day. This data is then compared with average need and average consumption in other areas of the world.

Lesson Objectives:
After completing this activity, each individual should be able to:
1. Explain the place of calories in their diet.
2. List common foods that could easily be excluded from our diet.
3. Compare consumption levels for major areas of the world.
4. Suggest acceptable means to bring our diets more in line with our needs.

Mechanics:
Teaching time: 50 minutes
Materials: Calorie Chart, Chalkboard

Activity:

1. Ask each person to list all the food and drink they have had in the last 24 hours. After they have made their list, pass out the calorie charts and tell them to write down the appropriate calories next to each item (some estimating may have to be done on amounts). After the calories have been calculated, ask each person to total their count.

List the number of people on the board which fall into each of the following categories: 1500 or less; 2000 or less; 2500 or less; 3000 or less; 3500 or less; more than 3500.

While the calculations are being made, the leader should also put the following chart on the board:

Average daily need world-wide	2700 calories
Average daily American Consumption	3000 calories
Average daily Asian Consumption	2450 calories
Average daily Latin American Consumption	2700 calories
Average daily African Consumption	2350 calories

15 minutes

2. Discussion--two objectives are to be derived from the discussion:

a. identification of our own consumption patterns
b. comparison with other parts of the world

Suggested questions for objective a:
1. What foods had high calorie content that were not nutritious? Identify the common responses.
2. What other foods were expendable?
3. What would have been the caloric totals excluding all foods listed as expendable?
4. Would it be sensible to eliminate all such foods? Why or why not?
5. What suggestions could be made from the above data to the average American on how to alter his diet? Would he likely stay as healthy with those suggestions?

15 minutes

Suggested questions for objective b:

1. How does this group compare with the average American? With other parts of the world?
2. What does the table tell us about the rest of the world?
3. What are the consequences of a below normal caloric intake?
4. What, other than calories is needed in a diet? Are these elements more likely to appear in balance in the other continents listed than in the U.S.? Why or why not?
5. What long-term consequences of diet deficiency are apparent in a whole society? How can Americans relate to these problems?

Future Suggestions:

1. Ask the group to make a similar calorie intake record for a week and see if it is appreciably different.
2. Ask the group to eliminate expendable foods for one week and then discuss the changes they felt resulted.

Calorie Count Listing

Meat and poultry (most meats and poultry figured here as lean, all visible fat trimmed off, about 60 calories per ounce):

bacon, fried crisp, 2 slices	95
beef, roast, lean, 4 oz.	210
beef, hamburger, lean, broiled, 4 oz.	245
beef, potpie, 8 oz.	460
beef, steak, lean, broiled, 4 oz.	235
bologna, 4" medium slice, each slice	85
chicken, turkey, broiled, 3 oz.	180
chicken, turkey, drumstick and thigh with bone, fried, 5 oz.	275
frankfurter, 1 medium size	155
ham, smoked, 3 oz.	290
ham, canned, all lean, 2 oz.	170
lamb, chop, broiled, lean only, 2.5 oz	140
lamb, leg, lean, 2.5 oz.	130
pork, roast, lean only, 2.5 oz.	175
pork, sausage, 4 oz.	340
tongue, beef, 3 oz.	205
veal, cutlet, broiled, 3 oz.	185
veal, roast, lean, 3 oz.	280

Fish and Shellfish:	
bluefish, baked, broiled, 3 oz.	135
clams, medium, each	9
crabmeat, 3 oz.	90
haddock, fried, 3 oz.	135
mackerel, broiled, 3 oz.	200
oysters, medium, each	12
salmon, canned, drained, 3 oz.	120
sardines, canned, drained, 3 oz.	180
shad, baked, 3 oz.	170
shrimps, medium, each	10
swordfish, broiled with butter, 3 oz.	150
tuna, canned, drained, 3 oz.	170

Vegetables:	
asparagus, medium, 2 spears	7
avocado, medium, half	185
beans, baked and canned types, 1 cup	320
beets, 1 cup	70
broccoli, 1 cup	45
Brussels sprouts, 1 cup	60
cabbage, raw, shredded, 1 cup	25
cabbage, cooked, 1 cup	45
carrots, raw, 5½", each	20
carrots, cooked, 1 cup	45
cauliflower, cooked, 1 cup	30
celery, 8" stalk, raw	5
corn, cooked, 5" each	65
corn, canned, 1 cup	170
cucumbers, 7½" each	25

raisins, dried, 1 cup	460
raisins, 1 level tbsp.	30
strawberries, fresh, 1 cup	70
tangerines, 2½" medium, each	40
watermelon, 4"x8" wedge	120

Dairy Products, Eggs, Fats, Oils, Dressings	
butter, 1 cup (2 ½-lb. sticks)	1605
butter, 1 pat or square	50
cheese, American, 1"cube	70
cheese, American, process 1 oz.	105
cheese, cottage, creamed, 1 oz.	30
cheese, farmer, pot cheese, 1 oz.	25
cheese, cream, 1 oz.	105
cheese, Roquefort-type, 1 oz.	105
cheese, Swiss, 1 oz.	105
cream, light, 1 cup	525
cream, light, 1 tbsp.	35
cream, heavy, 1 tbsp.	50
eggs, large, cooked without fat, each	80
eggs, scrambled, fried with butter, each	115
eggs, white only, raw, each	20
eggs, yolk only, raw, each	60
milk (cow's), whole, 1 cup (8 oz.)	165
milk, skim, nonfat, 1 cup	90
milk, buttermilk, cultured, 1 cup	90
margarine, 1 cup (2 1/4-lb sticks)	1615
margarine, 1 pat or square	50
oils, cooking and salad-corn, cottonseed, olive, soybean, 1 tbsp.	125
salad dressings, French, 1 tbsp	60
salad dressings, mayonnaise, 1 tbsp.	110
salad dressings, mayonnaise-type, 1 tbsp.	60
salad dressings, Russian, 1 tbsp.	75
yogurt, plain, 1 cup	120

Bread and Grain Products:	
bread, all types, plain, toasted slice	60
cereals, cooked, average type, 1 cup	105
cereals, dry unsweetened, average, 1 oz.	110
crackers, graham, medium, each	28
crackers, rye wafers, 2"x3½", each	25
crackers, saltines, 2" square, each	23
macaroni, spaghetti, cooked, 1 cup	155
muffins, 3" size average, each	140
noodles, egg, cooked, 1 cup	200
pancakes, 4" each	55
rice, cooked, 1 cup	200
rolls, medium size, average, each	130
waffles, average size, each	240

lettuce, 5" compact head, 1 lb.	.70
lettuce, 2 large leaves	5
lima beans, 1 cup	150
mushrooms, 1 cup	30
onions, raw, 2½" each	50
onions, cooked, 1 cup	80
parsley, raw, chopped, 1 tbsp.	1
peas, fresh, cooked, 1 cup	110
peas, canned, frozen, drained, 1 cup	80
potatoes, medium, baked, with peel	105
potatoes, medium, baked, without peel	90
potatoes, medium, boiled	90
potatoes, French-fried, 2" x ½", each	15
potatoes, mashed, milk, no butter, 1 cup	145
potato chips, 2" medium, each	11
radishes, raw, medium each	3
sauerkraut, drained, 1 cup	30
spinach and other greens, 1 cup	45
squash, summer type, 1 cup	35
squash, winter type, 1 cup	95
string beans, 1 cup	35
sweet potatoes, medium, baked	155
sweet potatoes, medium, candied	295
tomatoes, raw, medium	30
tomatoes, canned, 1 cup	45
tomato juice, 1 cup (8 oz.)	50
Fruit:	
apples, raw, medium	70
apple juice, 1 cup	125
applesauce, canned, sweetened, 1 cup	185
apricots, raw, each	20
apricots, canned in syrup, 1 cup	220
bananas, medium, each	85
blueberries, blackberries, 1 cup	85
cantaloupe, 5" medium, half	40
cherries, 1 cup	65
cranberry sauce, canned, 1 cup	550
dates, pitted, 1 cup	505
figs, dried, 2"-1" large, each	60
fruit cocktail, canned in syrup, 1 cup	195
grapefruit, 5" medium, half	55
grapefruit juice, fresh, 1 cup	95
grapes, 1 cup	85
grape juice, bottled, 1 cup	165
lemons, medium, each	20
oranges, medium, each	65
orange juice, fresh, 1 cup	110
peaches 2" medium, each	35
peaches, canned in syrup, pitted, 1 cup	200
pears, 3" medium, each	100
pineapple, fresh, diced, 1 cup	75
pineapple, canned in syrup, 1 cup	205
plums, 2" medium, each	30
prunes, cooked, unsweetened, each	17
prune juice, canned, 1 cup	170

Desserts, Sweets:	
cakes, angel food, 2" sector	110
cakes, chocolate, layer, 2" sector	420
cakes, cupcake, 2 3/4", with icing, each	160
cakes, plain, 3"x2"x1½" piece	180
cakes, sponge, 2" sector	115
candy, caramels, fudge, 1 oz.	120
candy, chocolate, milk or dark, 1 oz.	145
cookies, fig bar, small, each	55
cookies, average type, 3" round, each	110
chocolate syrup, 1 tbsp.	20
doughnuts, medium, plain, each	135
gelatin dessert, 1/2 cup	80
gelatin dessert, 1/2 cup sugar-free	10
honey, 1 tbsp.	60
ice cream, 1/2 cup	200
ice cream soda, average size	350
ice milk, 1 cup	285
jams, jellies, preserves, 1 tbsp.	55
pies, apple, other fruits, 4" sector	330
pies, custard, pumpkin, 4" sector	265
pies, lemon, meringue, 4" sector	300
puddings, custard, cornstarch, 1 cup	275
sherbet, ice, 1/2 cup	120
sugar, granulated, 1 tbsp.	16
sugar, granulated, 1 cup	770
syrup, 1 tbsp.	55

Miscellaneous:	
beverages, coffee, tea, plain	0
beverages, beer, 8 oz.	110
beverages, cocktail, average	150
beverages, gin, Scotch, vodka, whiskey, average 1 oz.	75
beverages, carbonated, ginger ale, 8 oz.	80
beverages, carbonated, cola-type, 8 oz.	105
cocoa, cup	235
ketchup, chili sauce, 1 tbsp.	15
olives, green and ripe, large, each	9
nuts, peanuts, roasted, shelled, 1/2 cup	420
nuts, cashews, pecans, walnuts, 1/2 cup	375
peanut butter, 1 tbsp.	90
pickles, dill 4", sweet 3" each	18
pizza, cheese, 6" wedge	200
soup, bouillon, broth, consommè, 1 cup	10
soup, chicken, tomato, vegetable, 1 cup	80
soup, creamed, asparagus, mushroom, 1 cup	200
soup, rice, noodle, barley, 1 cup	115

Title: Where People Go Hungry

Introduction:

Most people in the world need between 2200 and 2600 calories every day for adequate nutrition. Many people do not get enough to eat and many people eat just barely enough. In this activity students will become more aware of exactly who eats and who doesn't.

Objectives:

1. Students will use map making and graph making skills.
2. Students will compare continents and countries' food supplies.
3. Students will recognize which countries are well fed and which are not.

Materials:

A blank political map of the world for each student, colors.

Time: 1-2 Class Days

Activity:

1. Using the list of countries, students will make a map of where people are hungry. They can color-code their maps and make a key.
2. Using the Daily Average Food Supply data, have the students make a graph by world regions.

Debriefing:

1. What regions of the world are the best fed? The least?
2. What continent or region has the most undernourished people?
3. Where is most of the world's population? Are these countries well fed?
4. List some reasons why some countries' people are undernourished.
5. Is your country well-fed?

(Note to teachers - if time is a problem the students can do the map for their countries only and complete the graph)

Where People Go Hungry

Data Sheet*

Countries Consuming More than 3000 Calories (High Nutrition Level)	Countries Consuming 2600-3000 Calories (Above Adequate Nutrition Level)
Canada	Mexico
United States	Cuba
Argentina	Paraguay
Union of Soviet Socialist Republic	Chile
Finland	Uruguay
Sweden	Turkey
Norway	Egypt
East Germany	Libya
Poland	Ivory Coast
Denmark	Republic of South Africa
Czechoslovakia	North Korea
Hungary	South Korea
Yugoslavia	Japan
Romania	Iceland
Bulgaria	
Italy	
Greece	
Austria	
Spain	
Portugal	
France	
Switzerland	
West Germany	
Belgium	
Netherlands	
United Kingdom	
Australia	
New Foundland	
Israel	

*Data From Junior Scholastic Magazine, November 16, 1978
Statistical Source: 1977 World Food Supply, Food and Agriculture Organization

Where People Go Hungry

Data Sheet*

Countries Consuming 2200-2600 Calories or near Basic Nutrition Requirement)	Countries Consuming 2200 Calories (Inadequate Nutrition Level)	Less than 2000 Calories
Brazil	Guatemala	Yemen Arab Republic
Venezuela	El Salvador	P.D.R. Yemen
Guyana	Honduras	Afghanistan
Surinam	Colombia	Pakistan
French Guiana	Equador	India
Peru	Bolivia	Nepal
Nicaragua	Algeria	Bhutan
Costa Rica	Mauritania	Sri Lanka
Panama	Senegal	Burma
Albania	Guinea	Bangladesh
Morocco	Mali	Laos
Tunisia	Upper Volta	Cambodia
Gambia	Togo	Philippines
Sierra Leone	Benin	Indonesia
Ghana	Nigeria	
Cameroon	Niger	
Gabon	Chad	
Congo	Sudan	
Central African Republic	Ethiopia	
desia	Somalia	
agascar	Kenya	
awi	Uganda	
Saudi Arabia	Zaire	
Lebanon	Angola	
Syria	Zambia	
Iraq	Namibia	
Iran	Botswana	
Mongolia	Swaziland	
China	Mozambique	
Thailand	Tanzania	
Vietnam	Burundi	
Malaysia	Rwanda	
New Guinia		
Belize		

Daily Average Food Supply Per Person
(In Calories)
by World Regions

North America - 3600
Central and South America - 2500
Western Europe - 3400
Eastern Europe and Soviet Union - 2400
Near East - 2050
Far East - 2100
Africa - 2000

F20

Title: Rice (Film, 25 minutes, B/W) Available from Aurora Public Schools.

Introduction: Students of the world food problem will be better equipped to examine solutions to the problem, both immediate and long-range, if they understand something about the realities of the current situation. Such an understanding requires some knowledge of how and why people in areas of the world that are predominately hungry live as they do and what is being done to improve their condition. Ultimately, it means an appreciation of culture, religion, politics, and education, which is, of course, a massive undertaking. The film Rice does not pretend to accomplish these things. It does, however, bring to the group an example of life in a rural, poor village of Southeast Asia, and then shares the research being carried on by the International Rice Institute to assist these people in improving their life.

The concepts of change and interdependence are central to this film. Change is a key to any improvements in standards of living. Lack of change is graphically portrayed in its effects on the lives of the villagers. The interaction between people that is going on internationally to reach solutions to world problems is an excellent demonstration of interdependence.

The leader will find it helpful to have some background about the "Green Revolution."

Lesson Objectives:
After participating in this activity, each individual should be able to:
1. Suggest several reasons why people continue to live as their ancestors did without change.
2. Suggest ways in which technology could improve their standards of living.
3. Explain why current cultural norms may make it difficult for such people to accept change.

Mechanics:
Teaching time: One Hour
Materials: Film, Rice

Activity:
1. Introduce the film by explaining that it is an attempt to show how some people in the world live and ways research and technology might be used to improve their standards of living.
Show the film. 30 minutes.

2. Following the showing of the film, a discussion on how such efforts might help alleviate the food problem is suggested. However, the information in the film points out that the solutions are not cure-alls. Therefore, it is important to also discuss the limitations of the approaches suggested and to search for additional factors which may make the program more successful. Suggested questions:

a. Why do people in the mountain villages continue to live as they do? What cultural factors have developed that may make it difficult for them to change, even if they could be shown other methods of farming would improve their standard of living?
b. Research is often slow and frustrating. What can be done while the research that will alleviate the villagers' condition is being carried out? What might be done to prepare them for changes that the research will make possible?
c. What responsibility does a developed nation have to the villagers' cultural mores that may prevent adoption of seemingly obvious solutions?

d. What alternatives are open to the villagers besides increasing food production if they are to improve their standard of living? What other problems must be solved concurrently if new farming techniques are going to be successful?

e. Do solutions for the village have applicability for nations or regions? What problems are magnified to achieve those solutions?

Other Suggestions:

This activity will compliment the "Food Power" activity, which examines how solutions to the food problem might be practically implemented.

Title: Food Chain, Sharon Willsea

INTRODUCTION:

There are definite patterns within the hierarchy of plants, animals and man whereon one preys on another for survival. This is called the food chain.

OBJECTIVES:

Students will be able to identify what a food chain is and relate a food chain to man's survival.

MECHANICS:

Time: out of class time, several days
in class, 1 or 2 days

MATERIALS:

Six strips of paper, one-inch high varying in length from 5 feet to ½ foot, drawing materials.

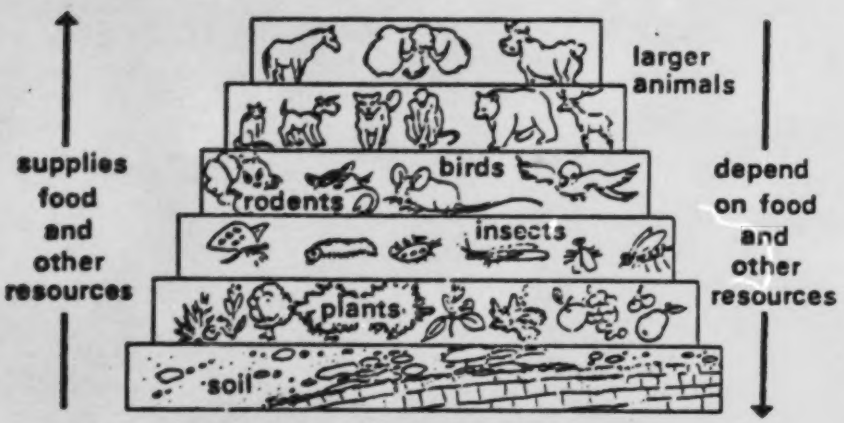
ACTIVITY:

Divide the class into six groups. Group one will draw a picture of the soil on the 5" paper. Group two will draw pictures of plants on a 4 foot paper. Group three will draw pictures of insects on a 3 foot paper. Group four will draw pictures of rodents and birds on a 2 foot paper. Group five will draw pictures of larger animals on the 1 foot paper, Group six will draw pictures of people on the ½ foot paper. Students should then put the strips of paper on the wall beginning with longest at the bottom (soil) and shortest at the top (man). This will depict the food chain and should show students the ratio of man's

Name _____ Date _____ Worksheet 2

Objective: To understand the idea of the *ecological pyramid.*

ALL LIVING THINGS ARE INTERDEPENDENT



Greater numbers of resources must be at the bottom of the pyramid.

Discuss or write a paper about any two of the following topics.

1. All living things are interdependent.
2. There are links in the food chain.
3. The balance of nature is best described as a pyramid.
4. The balance of nature is best described as a cycle.
5. In the long run, _____ have a better chance of survival than _____. (Fill in and explain your decisions.)

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Food Chain Discussion - Sharon Willsea

Introduction:

Once man understands the concept of the food chain, he should be able to make some assumptions as to the importance of the food chain and "man's" role in it.

Objectives:

1. Students should understand man's role in the "food chain."

2. Students should be able to make some assumptions as to what happens when links in the food chain are in imbalance.

Mechanics:

Time: 20 minutes or more
Materials: None

Activity:

1. Divide students into groups to brainstorm "What will happen to the food chain when man, the highest level, becomes too numerous for the food chain to support."

2. Alternative activity:
Students should research the topic "Resolved: The food chain will collapse when man, the highest level on the chain, becomes too numerous for the chain to support."

Additional Food Chain Activities

Seventh grade IIs Science Program

The Hawk and Field Mouse Game

The Food Chain Game

Title: "Why don't they just grow more food?" by Debbie Stein and Gary Johnson

INTRODUCTION:

One of the statements frequently heard in America is "Why don't they just grow more food?" This activity should help the students understand why some countries, even with more sophisticated technology and the desire to produce, could not meet the goal.

OBJECTIVES;

After completing this activity, students should be able to:

1. Suggest reasons why some countries cannot produce sufficient food for their population.

2. Compile and organize a chart sharing this data.

ACTIVITY:

1. A group of students should be selected to do this activity while others are doing something else such as a map activity.

2. Each student in the group is to be given a milk carton with soil. Different types should be used such as sand, humus, dirt, some with rocks, weeds. (The idea is to simulate various soil types in other parts of the world) They should also be give several seeds of corn.

3. Students should then receive a card with instructions for planting and caring for the seed. The instructions should simulate climate conditions in various countries. Each soil sample and growing condition should be different as well as interchangeable. For example: sandy soil--cold climate, sandy soil--constant water (rain), sandy soil--no water. Cards, such as the one below, can be made.

> 1. Plant your seeds in the milk carton provided.
> 2. Place the container in the refrigerator for three weeks.
> 3. Record your observation of growth every week.
> 4. At the end of three weeks, write a brief report on the results and bring the report and sample to the class.

4. After students complete the process, hypothesize as to reasons why things did not grow.

5. Compare the results of the experiment with the climate regions throughout the world.

Title: Map Activity, Sharon Willsea and Debbie Stein

Introduction:

It is important for students to realize that not all countries are endowed with the same quantities and qualities of resources. The result is a great discrepancy in how countries can "take care" of themselves.

Objectives:

1. Students will distinguish among countries with differing amounts of resources.
2. Students will identify countries which are not capable of producing enough food for themselves.
3. Students will identify countries which are not food producers, but do have the resources which can be traded for food.

Mechanics:

Several class periods will be required.

Materials:

Atlases, paper for maps, and colors

Activity:

1. In groups, students will make several maps of their country.
   A. physical map
   B. climate map - precipitation and temperature
   C. vegetation map - natural growth
   D. resource map
   E. population distribution map
2. On each map the students should write a paragraph summarizing in words what the map tells about the country (relating to its food producing capabilities)
3. Students will then fill out the chart for their country.
4. Using the overhead, the class can, together, fill out the chart for all of the countries.
5. The students can answer the questions referring to the chart and discuss results.

Questions on Chart

1. Which countries have the most cultivatable land?
2. Which countries have an adequate growing season?
3. Which have enough precipitation to grow crops?
4. Which grow edible crops?
5. Which have crops or resources to trade?
6. List any countries with none of these benefits.
7. What can these countries do to survive?
8. List the countries that can grow enough food to feed themselves?
9. What conditions are necessary for a country to be self-sufficient?
10. Which country in your opinion is most capable of feeding itself? Explain why.

CHART FOR [redacted] ITIVITY

Country	Size	Population	Population Density	Amount of Land Inhabitable	Amount of Arable Land	Length of Growing Season	Amount of Precipitation	Number of Edible Crops	Number of Tradeable Crops	Number of Tradeable Resources

Simulation in which students act as paramedics and victims in a plane crash.

VALUES
DECISION MAKING
CRITICAL THINKING
DISTRIBUTION

Title: TRIAGE*

Introduction:

Many people who examine population and food issues think there are not enough resources to go around. Some of these people have revived a concept called triage. Triage is a French word used to identify and help injured soldiers during wartime. Because of limited medical resources, injured persons were often divided into three groups. The group who received medical attention first was not the least or the most seriously injured soldiers but rather it was the injured soldiers who would benefit most from immediate medical attention. Such a decision was difficult but believed necessary to make under circumstances where there was limited access to medical attention. Many social scientists think this same approach could be used today in questions related to food aid.

In this activity, students simulate a medical crisis and apply the Triage approach to avert it. After the simulation, students discuss the Triage approach to population and food problems. It should be mentioned that this activity represents only one perspective on food aid, but it is one with which students should be familiar.

Objective:

Given a simulated activity about victims of a plane crash and limited medical attention available to them, students will categorize the victims according to the principle of "triage."

Time: Varies

Materials: Set of Injury Cards (Handout 2) and red, blue, and green tags

Procedure:

1. Preselect two students who will act as paramedics and instruct them in their roles. They are to examine each victim's injury card and to tag victims with a colored card, according to three groups: Group 1 consists of those victims whose injuries are so severe that they will die even if they are brought to the hospital quickly. Attach a red card to all victims you decide are in this group.

*This activity was developed by Don Boeckman, Westminster Public Schools, Westminster, Colorado. Used here with permission.

Group 2 consists of those victims who have a chance for survival if they can be airlifted to a hospital quickly. Attach a blue card to all victims you decide are in this group.
Group 3 consists of those victims who are likely to survive even if medical attention is delayed. Attach a green tag to all victims you decide are in this group.

2. Set the scene with the rest of the class, who will be the victims. A PLANE WITH 25 OCCUPANTS EN ROUTE FROM DENVER TO ASPEN ON A SKI TRIP HAS CRASHED HIGH IN THE MOUNTAINS. A LARGE MILITARY HELICOPTER WITH TWO PARAMEDICS HAS BEEN DISPATCHED TO THE SCENE. THE MEDICS ARE INSTRUCTED TO EXAMINE THE VICTIMS AND DECIDE WHICH ONES ARE TO BE TAKEN OUT ON THE FIRST TRIP, THE SECOND TRIP, AND THE THIRD TRIP. THE MAXIMUM SAFE CAPACITY OF THE AIRCRAFT IS TEN PERSONS. A ROUND TRIP TO A HOSPITAL TAKES TWO HOURS. NO OTHER HELICOPTER CAPABLE OF REACHING THIS ALTITUDE IS AVAILABLE.

3. Pass out the victims' injury cards at random and attach the cards to students' arms or clothing. Students may act out the injuries by lying on the floor or assuming a suitable position.

4. Paramedics examine the victims' injury cards, and attach a color-coded group card to each victim.

5. Paramedics then explain to the victims what the cards mean and which victims will be airlifted first, second, and third.

Debriefing:

Some possible probe questions are:

1. Do you think you were placed in the right group?
2. How do the students with the red tags feel?
3. How does the rest of the class feel about the students with the red tags?
4. Given the limitations of the story, is there a better way to handle the rescue effort?
5. Is there any other situation in which this kind of victim grouping (Triage) might have to be used?
6. In what respects is Triage as practiced in medical situations similar to food aid situations? Different?
7. Is Triage a good principle to use in considering food aid? Financial aid?

Evaluation:

Have each student write an essay that depicts a fictional story or an actual news story in which Triage might work when there is a shortage of available help.

1

Conscious and rational
Strong pulse
Able to walk
Bruises on head
Left arm broken, bone exposed

2

Conscious and rational
Strong pulse
Able to walk
Bleeding lightly from face and scalp cuts
Second degree burns on right forearm

3

Conscious and dazed
Strong pulse
Able to walk
Glass cut on face and right shoulder
Right eye lacerated

4

Conscious dazed
Weak rapid pulse
Staggering walk
Bruises on head and upper body

5

Conscious but hysterical
Weak, rapid pulse
Bruises on face and head
Left leg broken above and below knee

c 1977 CTIR

6

Conscious but hysterical
Weak, rapid pulse
Light bleeding from nose and mouth
Several teeth missing, jaw hanging down
Lacerations on face and right shoulder

7

Unconscious
Strong, regular pulse
Bruises on face and head
Second degree burns left shoulder and arm

8

Conscious and dazed
Weak, rapid pulse
Face lacerations - bleeding from nose
Second degree burns to lower left leg

9

Unconscious
Strong, regular pulse
Dislocated left arm
Second degree burn on forehead and scalp
Left leg broken below knee

10

Unconscious
Weak, rapid pulse
No apparent bruises or lacerations
No broken bones

c 1977 CTIR

11

Conscious and rational

Strong, rapid pulse

Face lacerations

Deep bruises on back - no feeling below waist

Third degree burns on hands

12

Unconscious

Weak, rapid pulse

Heavy bleeding inside right thigh

First degree burns on back

13

Conscious but hysterical

Weak, rapid pulse

Moderate bleeding from lower abdominal puncture wound

First degree burns on chest and left arm

Third degree burns on face

14

Conscious but dazed

Weak, rapid pulse

First degree burn on hands

First degree burns on left leg below knee

Second degree burns on right let from hip to ankle

Heavy bleeding inside left calf

15

Conscious but hysterical

Weak, rapid pulse

First degree burns on abdomen, chest, face and arms

Broken upper right arm with bone exposed and bleeding heavily

c 1977 CTIR

16

Conscious and rational

Weak, rapid pulse

Severe bruises on left arm and shoulder

Left forearm crushed with moderate bleeding

Crushing injuries to left hip with multiple fractures of pelvis and leg

Moderate bleeding from lacerations on left thigh

17

Conscious but dazed

Weak, rapid pulse

Severe bruise on nect and throat

Labored, rasping breathing

Lacerations on face and left shoulder

18

Unconscious

Faint, rapid pulse

Second and third degree burns over upper body above the waist

Multiple fractures of left hip and pelvis

19

Conscious and rational

Strong, regular pulse

Able to walk

No apparent injuries

20

Conscious and rational

Weak, rapid pulse

First and second degree burns on forearms and hands

Slight lacerations and bruises on face and scalp

c 1977 CTIR

21

Unconscious

Faint, rapid pulse

Severely mangled legs

Swelling of the abdomen

22

Unconscious

Faint, rapid pulse

Puncture wound in right chest

Gasping respiration

Multuple fractures of right arm

23

Unconscious

Weak, irregular pulse

Labored, difficult breathing

Slight bruises on face and chest

First and second degree burns on hands and forearms

24

Conscious but hysterical

Faint, rapid pulse

Labored, difficult breathing

Puncture wound in upper abdomen - heavy bleeding

25

Conscious and rational

Weak, rapid pulse

Slight bruises and lacerations on face and scalp

c 1977 CTIR

Title: "The Right to Live" A Film (by Debbie Stein)
Available at: Aurora Public Schools Media Center

Introduction:

In this activity, students will be asked to look at the factors which influence decisions we make. The film deals with the life and death situation and may be likened to the idea of who shall be fed.

Objectives:

1. Students should be able to list steps used in the decision-making process.
2. Students will be able to identify ideas which must be considered in decisions relating to food and population.

Activity:

Show the film with no introduction. Allow students to express their ideas about the film before introducing the process or decision-making. Pass out a copy of decision--making models. Have students attempt to fill in the steps used by the captain in the film. Discuss the following questions:

1. Should only the strong and healthy be fed?
2. Who decides who will be fed?
3. Should only those people who can support themselves be fed?

Extended Activity:

Have students do Lifeboat activity.

Divide students into groups. Each group should decide who should survive and be able to justify their choices to the rest of the class.

Lifeboat Activity - C. Stonebraker & P. Heist

Lifeboat

The following people have been in a disaster. Their pleasure cruiser has just sunk and there is room and supplies for seven people. Keeping in mind they will have to survive on an uninhabited island for an indeterminate time. Who should survive?

One boat captain - age 35
Two middle-aged females - overweight
One male child - asthmatic
One male - age 20 - ship's cook
One elderly male - good shape, wealthy, well-traveled
Two middle-aged male businessmen
One female - age 20 - tennis pro
One male - age 30 - university professor
One elderly female - famous, helped poor
Two teenagers, male and female - returning to school
One mother - age 25 with baby boy

Title: Apples * (by Gary Smith)

Introduction: One quick way of encouraging students to examine models for distribution of scarce resources is outlined in this activity. The grocery sacks (see below for details) can represent any number of kinds of leaders--political candidates, lifeboat captains, spaceship captains, etc. The activity is written up as if the sacks stand for political candidates. The idea is to get students as involved as possible in considering value questions regarding the distribution of the apples.

Objectives:
To reach consensus on a method of distribution and articulate reasons for doing so to the rest of the class

To recognize that personal and cultural values play a significant role in determining which system of distribution groups of students will choose

To make analogies between the activity and distribution systems throughout the world

To recognize the complex nature of deciding which kind of distribution system would be "best" for a group of people

Time: one class period

Procedure:

Step 1 - Buy seven large grocery sacks and three large, juicy apples. Using various colored marking pens, draw faces on each of the seven sacks. Make each face as distinctive as possible. The open ends of the sacks should face upward.

Step 2 - With a marking pen, make a sign for each candidate based on the information on page 3. Be sure to print and to make each sign legible enough for the entire class to read. Then, place one of the signs in each of the seven sacks. (Each sign stand for the "platform" of one of the seven candidates.) It would be best to keep the sacks and signs in the order suggested on page 3.

Note: You might want to suggest the day before the activity that students not eat the day of the exercise.

Step 3 - Display the three apples and the sacks (signs inside) on a desk or a table in front of the room. Explain to the class that they are to decide on a distribution system for the entire group.

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*Developed from an idea suggested by Bob Clifton, Metro State College, Denver, Colorado

Step 4 - Introduce each of the seven candidates, one at a time, in the order given on page 3. As you introduce each one, take the sign out of the sack and read and show it to the class.

Step 5 - Break class into groups of four. Have each group reach consensus on one of the candidates. The seventh candidate, or the one with the blank sign, can be used for students to make up a platform. Each group should spend about ten minutes reaching consensus and preparing a one minute talk on the candidate they've chosen to support.

Step 6 - Allow time for each group to give their talks . After all groups have given their talks, you may wish to conclude the activity by taking a class vote on each of the candidates, then distribute the apples according to which candidate or idea gets the most votes. In any case, however the class decides to choose a distribution system for the entire group, you should let them follow through and actually distribute the apples in the manner chosen.

Discussion:

1. It has been an attitude of many Americans that other countries have trouble feeding and clothing their populations because they don't know or can't decide (or can't implement) an "adequate" distribution system. Which system of distribution would you suggest for them? Did the class, as a class, reach concensus on the ideal distribution method? (Students should see that there are no right answers to this human dilemma, that the U.S. has certainly not decided on a single best method, and that value questions are an essential component in making decisions regarding distribution.)

2. Which candidates might represent what kinds of political, economic and/or philosophical positions? (Possible answers: No. 1= Puritan ethic; No. 2= Hedonistic; No. 3=capitalistic; No. 4=Commune; No. 5="Food Bank" idea; No. 6=Marxist)

3. What other distribution systems can you think of besides those mentioned in this activity? (Possible answers: TRIAGE SYSTEM=divides needy countries into groups according to their needs for food and food aid. Under this system, some people are completely left out (the most needy) and receive no food aid although they need it. Its supposed benefit is that crucial food surpluses would not be wasted on nations or peoples who have no chance of survival. "LIFEBOAT" APPROACH=coined by Garrett Hardin, this idea has the apparent disadvantage of denying food aid to the needy in an attempt to save the rich nations. Its apparent advantages are that it does not endanger the rich nations in times of crisis and does not attempt the hopeless task of feeding everyone.*)

4. In what ways were the members of your class interdependent in their decision-making?

*Adapted from "Explorations in the Emergent Present," Robert Hanvey, INTERCOM, No. 77, p. 40.

Candidate No. 1

"I would give the apples to the three people in class who worked hardest during the year."

Candidate No. 2:

"I would go get some more apples until we had enough for a party."

Candidate No. 3:

"I would sell the apples to the highest bidder."

Candidate No. 4:

"I would divide up the apples equally so that everyone in the class would get an equal amount."

Candidate No. 5:

"I would save the apples until we really needed them."

Candidate No. 6:

"I would give the apples to the three hungriest people in class."

Candidate No. 7:

BLANK SIGN

Title: Who Shall Be Fed?* (by Don Boeckman)

Introduction: The first part of the lesson is based on a fictional letter from a Peace Corps volunteer in Java to her younger brother in the United States. It serves to focus students' attention on the pressures of population in a country with limited resources, and on the degree of poverty which exists outside the U.S. By answering the same questions posed to Kim, the Javanese boy in the letter, students will notice the sharp contrast between their lives and that of the Javanese. In the second part of the lesson students will read short paragraphs outlining three possible approaches to treating the world food shortages. They will be asked to decide which of the three alternatives is most consistent with their ethical and emotional responses to Kim and the prospects of world survival.

Lesson Objectives:

1. Given a reading and discussion about food shortage and population growth in Java and given three suggested global policies in dealing with distribution of food resources, students will write a paper about how international food shortages may be treated. Students will clearly state which of the three alternatives they prefer and give a rationale why they chose that one and rejected the other two.
2. The participant will become familiar with three concepts: "Triage," "Lifeboat," and "food bank."
3. The participant will develop individual articulation in the writing of a considered value position.
4. The participant will increase his empathy and awareness of global food problems.

Mechanics:

Time: 1 class period

Materials: Duplicate the Food Policy Choice Card and the "Letter from Peace Corps Volunteer" Cards so that each student can have one of each.

Activity:

1. Pass out "Letter from Peace Corps Volunteer."
2. Point out Indonesia and Java on the map so students can visualize their locations.
3. Introduce the letter to the class by saying it is a letter to her younger brother from a Peace Corps volunteer working in Java, part of Indonesia. Tell students as they read the letter to pay close attention to the description of living conditions in Java.
4. Ask students to describe Java's physical characteristics.
5. Have students describe Kim's family and their life.
6. Ask students why Kim's family has such a difficult time obtaining enough food. You might then discuss the significance of

population density. Does high density necessarity mean that a nation will have many poor, underfed people? Can students name other nations that have high population densities? Students may cite high density countries such as Japan and the Netherlands, which don't suffer serious food shortages. What distinguishing factors do students see between these two countries and Java? (Most important is the high level of industrial development of both Japan and the Netherlands which enables them to pay for imports of food and large quantities of fertilizer. Since Java has few alternative sources for acquiring money, the pressures from growing population serve to perpetuate and worsen the poverty.)

7. Ask students to consider Karen's statement that while Kim's father can afford little fertilizer to prepare his land for cultivation, people in this country use it to beautify their lawns. Do students see any causal links between the high level of fertilizer usage in America and the low level in Java? What connections might there be? (High demand and high ability to pay for fertilizer in the United States -- and other industrialized nations --make fertilizer sufficiently expensive so that poorer nations can afford to buy it in only small quantities. Sharp increases in the price of crude oil since the October 1973 Mideast war have also increased the cost of fertilizer because oil is an important element in its manufacture. Thus, poorer countries have been further forced to curtail fertilizer purchases.)

8. Now tell students they are going to consider some alternatives to how international food shortages might be treated. Pass out the Choice Sheets, asking students to read them carefully and decide which alternatives best meet the needs of the world.

9. Make written assignment asking students to state which of the three alternatives they prefer and give a clear reason why they rejected the other two choices.

10. This may be turned in at the end of the period or the following day.

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*Adapted from a lesson designed by Paul M. Armstrong appearing in Intercom #77 by Robert Hanvey. Reprinted by permission from The Center for War/Peace Studies, New York, New York.

LETTER FROM A PEACE CORPS VOLUNTEER

Sawahrejo, Indonesia

Dear Bob,

Since I haven't written to you in so long I thought you might want to share this letter with your classmates. They might also like to know what life is like in the Peace Corps.

As you know, I am working on the island of Java, part of the country of Indonesia. Java is very mountainous, with many volcanoes, and rich valleys where crops grow easily. As I look out from the window of my house, as the sun goes down over the mountains, I can agree with the Javanese people that this is truly a beautiful place.

Unfortunately, Java is a place not only of beauty. In the village of Sawahrejo where I live, there are 2,000 people who live closely packed together in very small houses. And the population here is growing very rapidly. Most of the villagers own very little land or no land at all. Even though the land is fertile, there are too many people trying to work a tiny plot and there is not enough food for everyone. To give you an idea of how dense the population is here, if the United States were as densely populated as Java is, it would have more population than the entire world now does. Not only are the people crowded together on the land, but there are very few jobs available for people who need to work to buy food for their families.

Recently, I met a boy about 11 or 12 years old named Kim. He lives with his mother and father, three sisters, and one brother. He had two other brothers, but they died of starvation when they were young. I asked him some questions about his life here.

Me: "What does your family eat?"

Kim: "We eat rice mostly but sometimes fruit or cassava." (Cassava is a filling, but not very nutritional root.)

Me: "How many times a day do you eat?"

Kim: "Sometimes twice but usually only once, in the evening. It depends on how much food we have."

Me: "What do you like to eat?"

Kim: "I like fruits like belimbing, jambu, and nagka." (These are fruits not found in the United States.)

Me: "Where do you get your food?"

Kim: "We own about 900 square meters (one-fifth of an acre) where we grow most of the food to feed our family. My father buys a little food, but he is able to find work only about one-third of the year, so we don't have much extra money."

Me: Does your mother prepare all the food you eat?"

Kim: "Yes, my mother cooks rice and fruit, if there is any." (Of course, Kim's family does not have a refrigerator.)

Me: "How much do you weigh?"

Kim: "Thirty-five kilos." (I later discovered he weighs thirty-one kilograms—less than seventy pounds.)

Kim and his family have the same problem as most of the other people here. I found out that Kim's family can grow five hundred pounds of rice on their small piece of land in a good year. His father is able to buy seeds and only about nine pounds of fertilizer with the little money he has available. Most people in the United States put far more fertilizer than that on their lawns each year.

I must end this letter so it can be sent out today, but I thought your class might like to try answering the questions I asked Kim and then comparing your answers with his answers. I would be interested in the results.

Love,
Karen

WHO SHALL BE FED? - CHOICE SHEET

A. Triage—The French developed the Triage system for handling battle casualties. As each wounded soldier came to the hospital, doctors examined him quickly and then assigned him to one of three groups: those who could not be saved no matter what was done for them; those who could not survive without aid but would survive with aid; and those who would survive if nothing were done for them.

Using this system, the nations that have extra food would make a decision to divide the other nations of the world into three groups:

Group 1. Nations that need a great deal of food aid over a long period of time but could not be saved because their problem is too great. These nations would be given no aid.

Group 2. Nations that need food aid over a long period of time and probably will survive if helped. These nations are given the aid they need.

Group 3. Nations that need aid but have a good chance of survival if none were given. These might get help, but only after Group 2 has been aided.

• *The "triage" approach* divides needy countries into groups according to the ability of food aid to help in their situation. Under this system some people are completely left out and receive no food aid although they need it. Its perceived benefit is that crucial food surpluses would not be wasted on nations with no chance of survival.

B. Lifeboat—Imagine a lifeboat filled with survivors. Around the lifeboat are others swimming in the water and desperate to get aboard. If they are allowed in, the lifeboat will swamp and all will lose their lives. The rich nations of the world are in the lifeboat. The poor are swimming in the water, begging to be allowed in the boat.

The rich nations cannot feed the hungry people of the world. If they try to feed everyone, the world food supply will be spread too thin and everyone will suffer. When the first crisis arises, because of bad weather or another reason, the available global food supply will not be adequate to feed everyone.

Because the populations of the poorer nations are growing at a faster pace than the rich nations, there is a larger and larger demand for the limited food available. Giving food aid may simply encourage the population explosion of the poor nations.

• *The "lifeboat" approach** has the apparent disadvantage of denying food aid to the needy in an attempt to save the rich nations. Its apparent advantages are that it does not endanger the rich nations in times of crisis and does not attempt the hopeless task of feeding everyone.

C. World Food Bank—Another proposal would be to put all the extra food in the world into a World Food Bank and let each nation that needs food at any time take food out of the bank to feed its people.

• *The "world food bank" approach* has the perceived disadvantage of rapidly depleting the world food surpluses and possibly encouraging the poor nations to continue rapid population growth. Its perceived advantage is that everyone would have equal access to the world's surplus food regardless of national boundaries.

Students rank order solutions to food distribution problems, based upon who has the power and authority to implement such solutions.

POWER
INTERDEPENDENCE
DECISION MAKING
VALUES

Title: FOOD POWER

Introduction:

This activity is designed to force people to consider questions that are often ignored when citizens make value decisions about the best methods to resolve world food distribution problems. The purpose is to have students suggest and discuss the power factors that must be considered in examining solutions to food distribution on a global scale. The purpose is not to have students arrive at a firm decision, based on facts, about the best solution to food distribution problems, but students are expected to consider what is possible in setting food policies, in light of the power factors.

Objectives:

To identify at least five power sources that influence food policy.

To state why a solution to the food problem is interdependent in nature.

To recognize that there may be a difference between the desirable and the possible in establishing world food policy.

To recognize that the food problem must be treated from a global rather than a national perspective.

Time: One class period

Materials: Handout 18, Food Power, one per student

Procedure:

1. Explain to the group that the goal of this lesson is to select the best solution to the world food distribution problem from among the choices given, based on what they now know. A definition of "best" ultimately might mean the most desirable solution that can in reality be accomplished. However, at this point emphasis should be placed only on the most desirable solution from each student's perspective.

2. Distribute Handout 18 to the students. For part one on the handout, ask the group to rank order the five choices that they as individuals think are the best approaches to the food problem. You will probably have to explain the solutions to the students. The vocabulary may be difficult.

3. Summarize the data and analyze it, using the following questions:

   A. Who would or does have the power to implement this idea?
   B. Who would or does have the power to effectively prevent the implementation of this proposal?
   C. Who would be given the authority to carry out the idea?
   D. Do those who have the authority to make the decisions necessarily have the power to implement them?

   Possible answers to A, B, and C are: national governments (the role is likely to be different for developing as opposed to developed countries), farmers, organizations, international agencies such as the UN and its related agencies (FAO, World Bank, etc.), multinational corporations, the Common Market, OAS, etc. The discussion may conclude that there are more groups capable of preventing an action than there are those that can implement one, although the relative power of groups is also a factor. It will also show that there are agencies which are primarily national in scope making the decisions for an international problem. Also, most of the solutions cannot be approved and carried out by the same body, i.e., item 7 would require approval of the major fishing nations, and in some cases the industry within the nation, but none of these could carry out the idea.

   Question D can be answered <u>yes</u> primarily in those solutions that are national in scope. It will be almost always <u>no</u> for those that call for international cooperation and/or management.

4. Ask the group again to rank order the suggestions in part one on the handout which they think are most likely to be achieved. They should consider the discussion on relative power and authority factors involved.

5. Discuss the new ratings. Are there changes? If so, why? Are students more pessimistic or less pessimistic about solving food distribution problems? Some factors affecting their opinions might be:
   A. The relative ease with which a particular power group may be influenced.
   B. The number of power groups that might benefit from such a decision.
   C. The benefits that may accrue to the most significant power groups.
   D. The existing machinery available for implementing such a decision.

Food Power

1. Rank order the following suggestions according to which you think is the best approach to world food distribution problems. For example: 1 indicates the suggestion you feel is best, 2 is the next best, and so on. Continue until you have made five choices.

_____(1) Return all of the unused U.S. cropland to production.

_____(2) Establish a world food bank to be built up by countries who have food and taken from by countries who don't have enough food.

_____(3) Establish a plan for globally coordinated national grain reserve policies.

_____(4) Increase U.S. technical and financial assistance for increasing the food production of the developing countries.

_____(5) Develop a long-term food aid policy in which countries with extra food give that food through an organization made up of many nations, such as the World Bank or United Nations.

_____(6) Change food management and land ownership to allow for maximum government control of food production.

_____(7) Establish an international group to control fishing in the world's oceans.

_____(8) Give countries that depend on one crop or product special treatment in the world trade market. For example, one country's corn may sell at a higher price than a country that raises other crops also.

2. Questions for discussion: Power and Authority

A. Who would or does have the power to put this idea into effect?

B. Who would or does have the power to effectively prevent the implementation of this proposal?

C. Who would be given the authority to see that the idea would be carried out?

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D. Do those who have the authority to make decisions necessarily have the power to implement them?

3. Now rank order the suggestions again from 1 to 5, indicating which proposals you think are most likely to be implemented, given the power and authority factors.

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Title: Editorial: Issues of Food (Mary Lou Mohler)

Introduction:

Due to the increasing world problem of food shortages, more and more opinions about the problem and suggested solutions are being expressed through the media. This activity gives the students a means of expressing their views, and an understanding of the purpose for editorials.

LESSON OBJECTIVES:

After completing the activity, the student should be able to:

1. State a position on the food issue and support the position.
2. Write an editorial on the food issue.
3. Identify positions taken in some current editorials.

MECHANICS:

Time: One class period
Materials: Editorial pages from several newspapers or magazines.

ACTIVITY:

1. Discuss the purpose of editorials with the class.
2. Pass editorials clipped from newspapers, and magazines to each member of class. Have them identify statements and support.
3. Class members each write their own editorial based on previous discussions of the food issue.

Energy

Title: PERSONAL INVENTORY

Introduction: If students want to know what they can do about the "energy problem," they can start with their own personal life styles. The following activity is designed to check students' energy consumption and give cause for reflection on ways students can conserve.

Objectives:

To inventory student behavior regarding their consumption of energy.

To reflect on and change student behavior about personal energy consumption.

Grade Level: 7-12

Time: 30 minutes

Materials: Handout, "Personal Inventory"

Basic Skills Focus: A. Forming generalizations from data

B. Values clarification

C. Observation

Procedure:

Step 1. Distribute one copy of the handout to each student.

Step 2. Allow time for students to fill out the survey.

Debriefing:

1. According to the inventory, are students spending energy or saving energy?
2. Discuss what specific ways students could change their habits to conserve energy.

Patricia A. Heist

PERSONAL INVENTORY

_____1. When I leave a room, I always turn out the light if it is not needed by someone else.

_____2. When no one is watching the TV or listening to the radio, I always turn them off.

_____3. When I get a car (or if you have one), my first concern will be how much energy it will save.

_____4. When I eat, I always take as much as I can eat, and eat all that I take.

_____5. I walk, ride by bicycle, or take the bus to school instead of using the car.

_____6. I am willing to make changes in my life style to conserve energy.

_____7. I check to see that the thermostat is set no higher than 68 degrees in the winter.

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Title: WHAT ARE THE POWER USERS?

Introduction: Modern American households are full of many items that use power of various forms. The purpose of this activity is to give the students an opportunity to list and examine what these power-users are. It is interesting to examine the various sources of power used in the home.

Objectives:

To list and examine things around the house that use power.

To classify the items according to kind of power used.

To determine what kinds of power are used most frequently at home.

Grade Level: 1-12

Time: Part of two class periods and time at home

Materials: Pencils and paper

Procedure:

Step 1. Have a short class discussion about things which use power. Include the following kinds of power in the discussion: battery, gasoline, electric, natural gas, hand power, oil, air, and solar. Some examples are:

battery:	flashlight, toy robot
gasoline:	lawn mower, car
electric:	lights, refrigerator
natural gas:	furnace, water heater
hand power:	food grinder, non-electric can opener, broom, screw driver
oil:	oil lamp, some furnaces
air:	toy pin wheel, wind mill, clothes line
solar:	greenhouse

Step 2. Ask the students to make a list of as many things as possible in their homes which use power of any kind.

Step 3. The next day in class ask students to organize the items in their lists according to the kinds of power used (refer to the above examples.)

Gary R. Smith

Step 4. On large sheets of paper (or on the chalkboard) write the following headings:

A. battery	E. hand power
B. gasoline	F. oil
C. electric	G. air
D. natural gas	H. solar

Step 5. With the students referring to their own lists, compile a master list which will include everything on all the lists the students made at home.

Step 6. When the master list is complete, discuss it using the following questions:

A. What do you notice first about the lists?
B. Do some categories include more items than others? Why?
C. Can you see any items in the lists which could be powered differently? (Or do some items appear in more than one list? Example: can opener and electric can opener.)

D. What items in your home could be hand powered instead of being operated by batteries, electricity, or other power?

Step 7. Does this list give students any insights into the Energy Crisis? What are they?

Step 8. Have students list ways in which we consume energy wastefully. List ways in which we consume energy wisely. List changes they would like to make in the ways they and their families conserve energy.

Title: WOULD YOU BELIEVE?

Introduction: New inventions have created more uses for energy. Americans using these new luxuries have become greater energy consumers. This activity gives students a chance to check what energy users they are accustomed to having which were not part of their parent's childhoods.

Objectives:

To compare students' childhood experiences with their parents' childhood experiences.

To identify items and experiences as "users of energy."

Grade Level: 4-12

Time: One hour

Materials: Handout, "Would You Believe"

Procedure:

Step 1. Distribute handout to students and ask them to think. Have students complete the handout.

Step 2. Collect students' responses and list in one column on a chart. Make a second column for alternatives the parents may have had to use or experience.

Step 3. Have students brainstorm items which may be placed in their parents' column.

Debriefing:

1. Do many of the same items appear on everyone's list?
2. Do students consider these items necessary? Which one would they be willing to give up?
3. How did their parents live without these items or experiences? Would students like to have experienced their parents' childhood?
4. Which items on the list would students classify as energy "users"?

Patricia A. Heist

5. Have students check their answers with their parents and discuss what their parents' childhoods were like. Steer them toward discussing energy uses and consumption patterns.

??...WOULD YOU BELIEVE...??

Name ten things that you have or experience which were unknown, impossible, or unimaginable for your parents when they were your age.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

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Title: ENERGY USING GADGETS

Introduction: The average household has about 29 small electrical appliances that use almost 10% of the energy consumed in the home and cost us precious dollars to operate. Some of these gadgets are necessary and helpful in everyday living, but the majority are "convenience gimmicks" that are wasteful and inefficient. Simple tasks like carving meat, combing hair, brushing teeth, washing dishes, squeezing juice and opening cans should be performed with human energy and not electrical energy.

Objectives:

To demonstrate an increased awareness of student energy consumption.

To collect and categorize data.

To identify alternatives for some energy consuming products.

To determine amounts of energy consumed by household appliances.

To demonstrate skills in data interpretation.

Grade Level: 5-12

Time: 1-2 class periods and time at home

Materials: Handouts, Cartoon and "Energy Using Gadgets"

Procedure:

Step 1. Distribute handout of cartoon to students. Probe them for their interpretations of cartoon using the questions provided.

Step 2. Have students identify the appliances shown in the cartoon. How many of them are in their *own* home?

Step 3. Distribute "Energy Using Gadgets" (3 pages). Directions are provided. This activity requires some work at home. Students will list each energy producing gadget or appliance in their homes.

Jacqueline Johnson

Step 4. After they have gathered their data, students then complete the chart, "Energy Using Gadgets." Encourage students to categorize their data.

Step 5. Have students determine actual energy consumption of each appliance. To calculate the number of kilowatt hours (kwh) used per month, multiply the wattage by the number of hours you expect the appliance to be used in one month. This will be the number of watt hours. Divide by 1000 to get kwh.

Example: Electric coffee pot used 1/2 hour per day:

$$\frac{15 \text{ hrs/month} \times 890 \text{ watts}}{1{,}000} = 13.4 \text{ kwh/month}$$ (multiply by 12 for kwh/year)

Step 6. Encourage students to verbalize responses in the column labeled "substitute." Have they ever actually *used* or *done* the substitue activity?

Step 7. It is important to stress that although many of these small appliances consume little energy, it nevertheless takes a great deal of energy to produce them.

Step 8. Connect this data-gathering activity to the following discussion prompters:

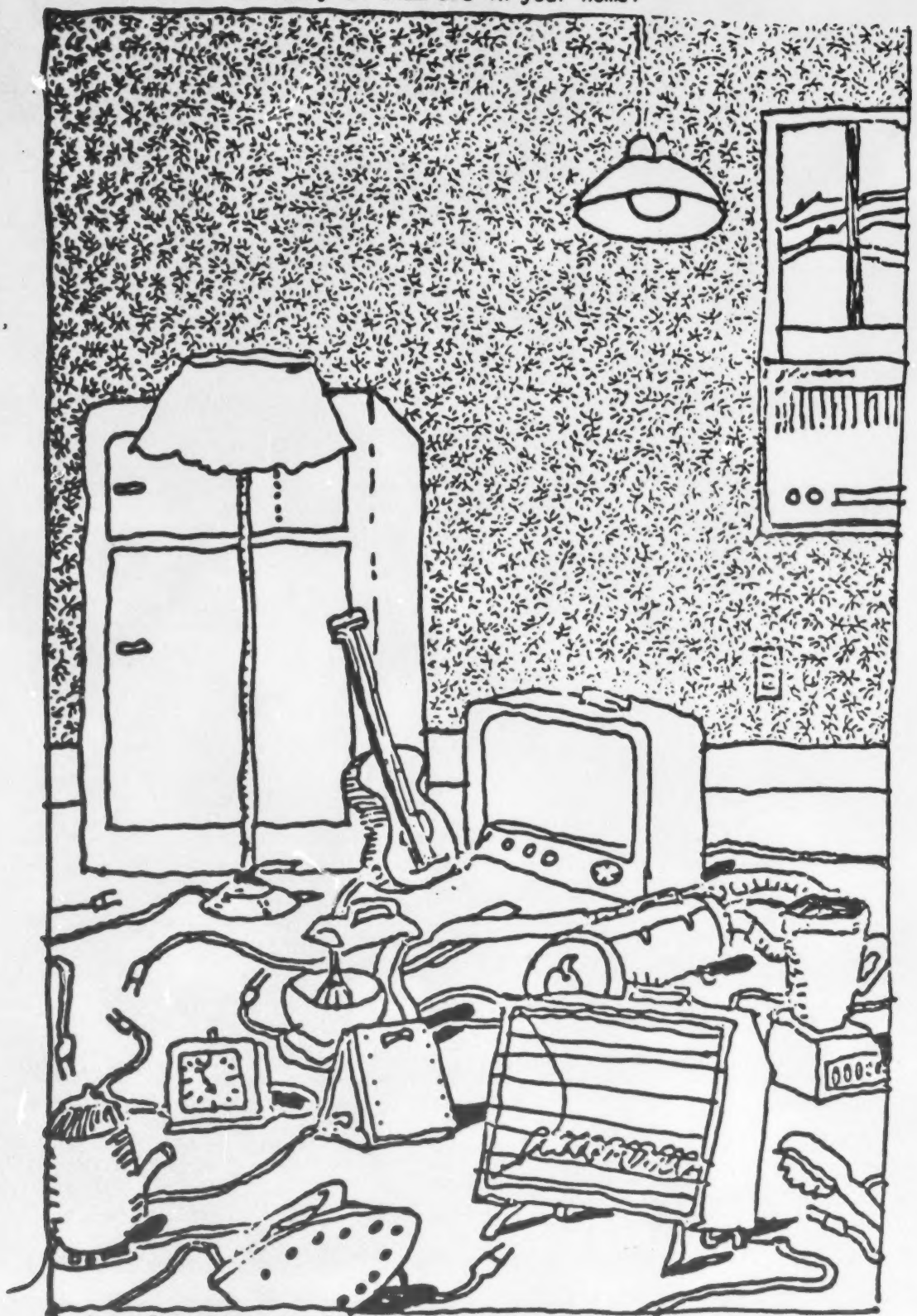
A. People in the U.S. consume 100 times the amount of energy as the average person living in South America.

B. The U.S. is 6 percent of the world's population and consumes 40 percent of the world's resources.

Follow-up:

Ask students to actually do several substitute activities for one week.
Example: Towel dry hair instead of using a hair dryer.

Directions: Identify all the appliances on this page.
How many of them are in your home?



Cartoon from Education Development Center, Inc.
"What Is Energy?" *People and Technology* (1973), p. 20

E10

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ENERGY USING GADGETS

The average household has about 29 small electrical appliances that use almost 10% of the energy consumed in the home and cost us precious dollars to operate. Some of these gadgets are necessary and helpful in everyday living, but the majority are "convenience gimmicks" that are wasteful and inefficient. Simple tasks like carving meat, combing hair, brushing teeth, washing dishes, squeezing juice and opening cans should be performed with human energy and not electrical energy.

Directions:

1. Count the number of electrical appliances in your own home._____
2. Create categories for your appliances (i.e., kitchen devices, gardening tools, entertainment, grooming appliances).
3. List your appliances in categories on the following page.
4. Do some research to determine the number of *kilowatt hours* each appliance consumes annually. A kilowatt hour is most often used when measuring electrical consumption in homes and factories.
   Example: a 100 watt bulb burning for 10 hours uses 1 kilowatt hour of energy.
5. Now, brainstorm a substitute for each appliance.
6. List the appliances that are used most frequently (i.e., on a daily basis).
7. List the appliances that are absolutely necessary.
8. List the appliances that you can easily do without.

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ENERGY USING GADGETS

ENERGY APPLIANCES IN MY HOUSE	KILOWATT HOURS CONSUMED ANNUALLY	SUBSTITUTE If you didn't have it, what would you do or use?

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Electric Appliances	Kilowatt Hours Consumed Annually	Substitute
Blender	15	egg beater and strong arm
Carving knife	8	sharp knife
Coffee maker	106	do without
Dishwasher	363	wash dishes by hand
Egg cooker	14	cook eggs in boiling water used for tea or coffee
Garbage disposal	30	compost food waste
Trash compactor	50	manually shred trash and crush cans
Clothes dryer	993	hang clothes to dry outside in summer and inside in winter (to help humidify)
Iron	144	wear permanent press clothing
Electric blanket	147	sleep with extra blankets
Humidifier	163	put a pan of water on the radiator, hang up wet clothes, or open the bathroom door after a shower
Portable heater	176	heavier clothing
Hair dryer	14	dry towel, strong arms
Germicidal lamp	141	do without
Sun lamp	16	go outside and enjoy the sunshine
Shaver	1.8	grow a beard
Toothbrush	.5	brush by hand
Vibrator	2	physical exercise
Clock	17	wind-up clock
Can opener		manual can opener
Lawn mower/clipper		hand-powered mower/clipper
Hedge clipper		hand-powered clipper
Saw		hand-powered saw
Paint mixer		hand-powered mixer

E13

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A selection of ads on energy are provided as advertising data to analyze.

Title: ENERGY ADS

Introduction: A great deal of advertising has been given impetus by the energy crisis. Ten years ago the advertisements on the accompanying handouts would not have been in print. This activity asks students to look at a series of ads to analyze some of the basic techniques employed.

Objective:

To deduce and list some of the basic issues that are addressed in energy advertising.

Grade Level: 4-12

Time: 1½ hours

Materials: Handout, "Energy Advertising"

Procedure:

Step 1. Divide class into three groups of students.

Step 2. Distribute five handouts to each group so that each group has different ads.

Step 3. Ask each group to concentrate on the following questions:

a. What solutions to the energy crisis are suggested in the ads?

b. Are consumers being asked to consume rather than to save?

c. Why would oil companies and utility companies wish to advertise for conservation when their main interest is in selling products?

d. What new companies might be started as a result of the energy issue?

Gary R. Smith and Patricia A. Heist

Step 4. Categorize ads in the following categories (some ads can be put in more than one category):

a. conservation

b. energy alternatives

c. types of industry or company

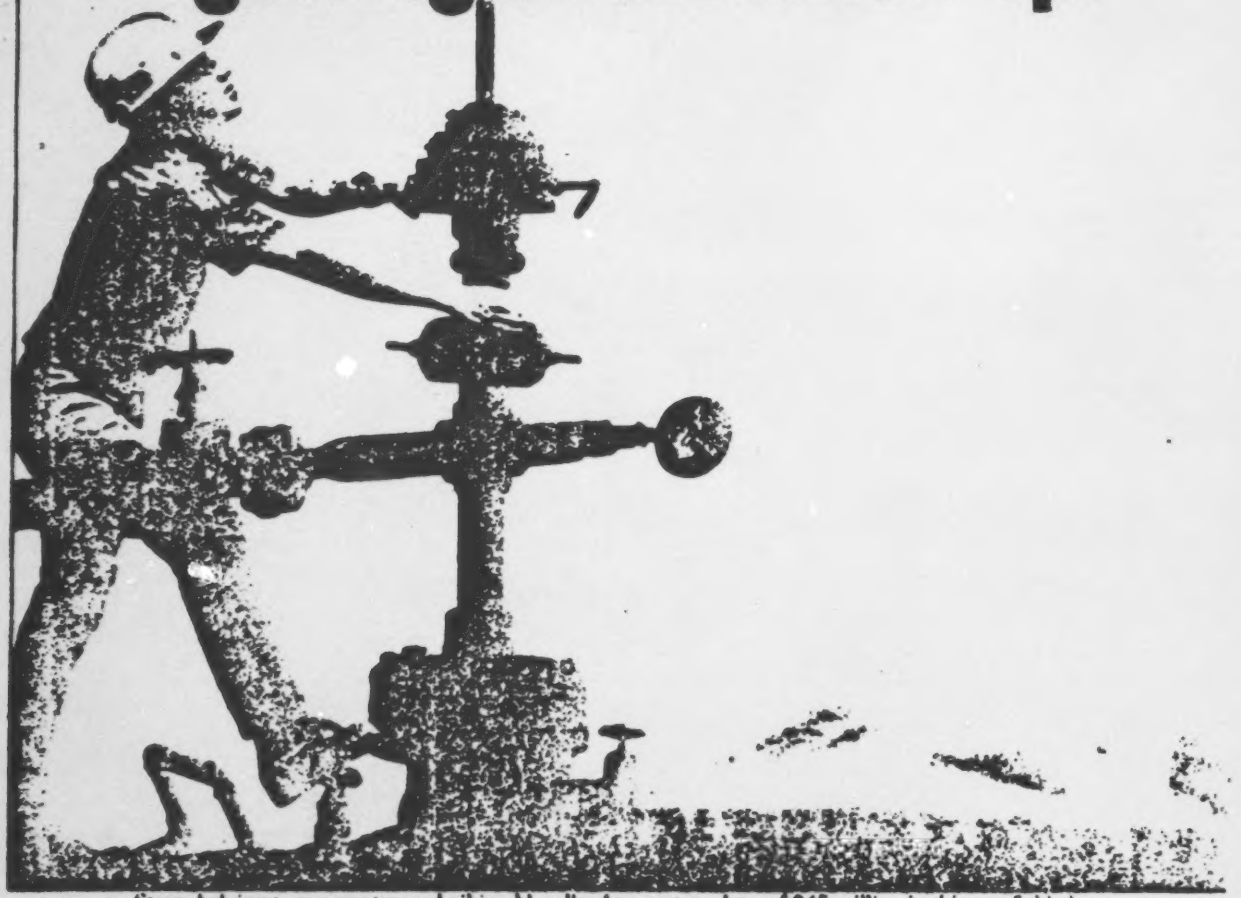
d. types of energy

e. any other categories students can brainstorm

Step 5. Discuss what specific products are being advertised to save energy.

Step 6. Looking at the advertisements, can students see a reason for gasoline, coal, and other energy related prices to increase in recent years?

Why some old oil wells are getting all steamed up.



Steam helping to recover trapped oil in old wells. At a cost, to date, of $45 million in this one field alone.

Maurice F. Granville, Chairman, Texaco Inc.

We're going all out to get you the energy you need. That includes more than exploring. More than drilling. And more than developing alternate sources of energy.

We're going back to reopen old oil wells. They're wells that were no longer productive and we had no practical way to recover the oil we knew remained. But today, we are able to recover some of that oil.

At one field here in the U.S., we are using steam as a recovery method. We're forcing steam down 44 wells there. The heat and pressure of the steam work to help loosen the oil and aid recovery.

It's an enormously difficult and expensive operation. So far, we've spent $45 million and we estimate we'll have to spend about another $147 million before the field is depleted. And it's just one of the many ways we're working hard to meet your energy needs for the future.

TEXACO

We're working to keep your trust.

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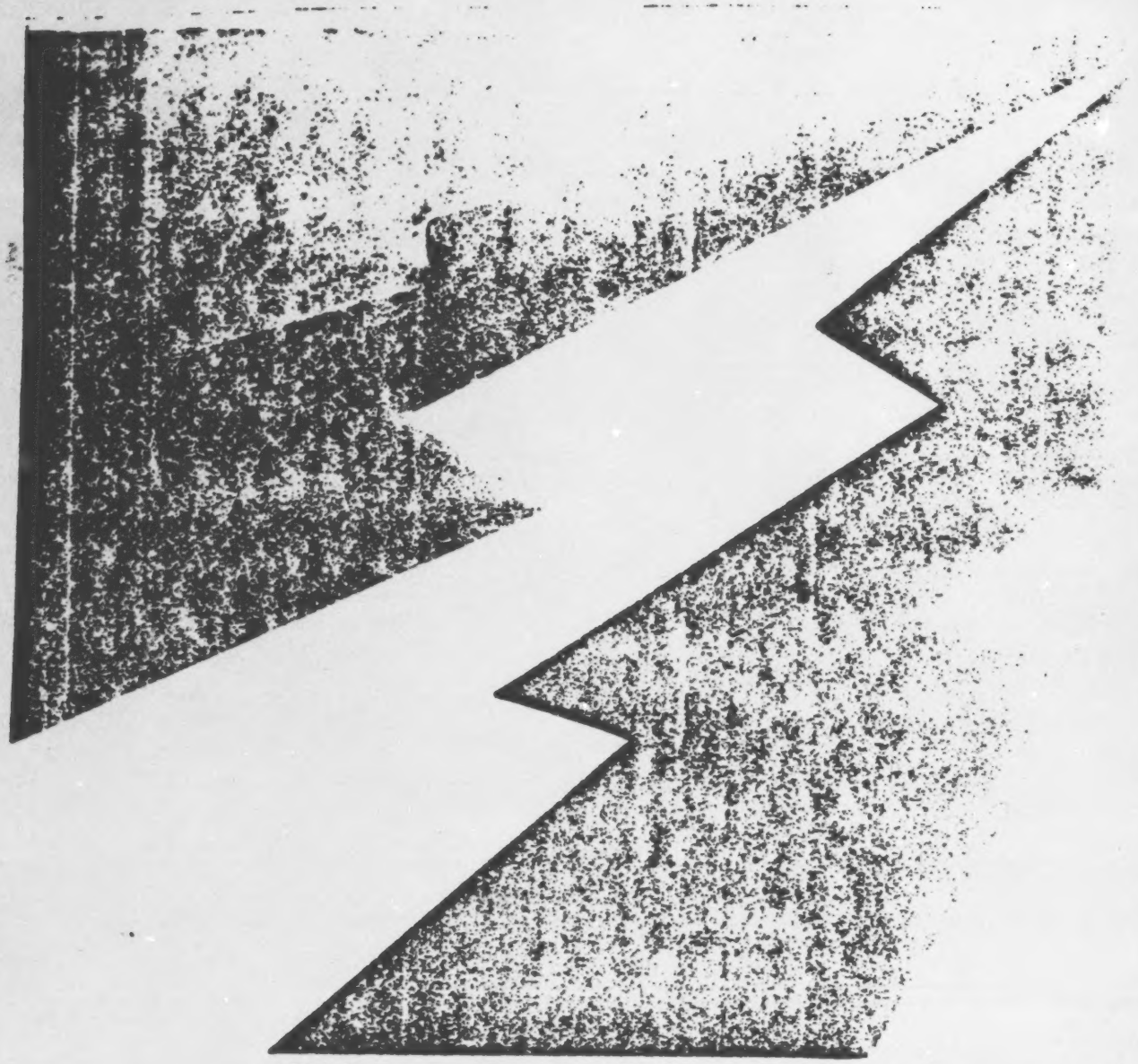

To become less dependent on foreign oil, we need more than American oil. We need American energy.

In the last few years, America's dependence on oil from other countries has increased to about 45 percent of our total consumption.

One way to reduce that dependence is to conserve energy—to use it more wisely and efficiently.

And while companies such as Conoco continue to search for more domestic petroleum, it's imperative that we also develop other kinds of energy.

For example, there's enough coal and uranium in the U.S. to meet our energy needs until solar power and other fuels of the future can begin to play a significant role.

We think it's a good thing that Conoco has the skilled people and the financial strength to go beyond petroleum—into coal, uranium and newer forms of energy.

That's the best way to reduce our dependence on foreign oil.

CONOCO

Doing more with energy.

To learn more about what we're doing with energy, write Dept. D, Continental Oil Company, Stamford, Conn. 06904

E17

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Apache Oil and Gas Program 1978

$35,000,000

Price $15,000 per unit (minimum investment ½ unit)

Program I: $20,000,000; closes June 15, 1978

Program II: $15,000,000; closes September 15, 1978

The program, with Apache Corporation as its operator, will explore for and develop oil and gas reserves in the United States. 85% of the funds will be devoted to exploration and 15% invested in the drilling of developmental wells.

This advertisement is neither an offer to sell nor a solicitation of an offer to buy any of these units. The offer is made only by the prospectus and only in those states where the units may be lawfully offered or sold.

FOR PROSPECTUS SEND COUPON BELOW:

Apache / Petroleum Tower, Minneapolis, Minnesota 55402, 612-339-7882

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

TELEPHONE _____

OCCUPATION (if applicable) _____

INVESTED BEFORE? ☐ Yes ☐ No

The purchaser of a unit must represent, among other things, that he has either a net worth of $30,000 or more, and had during his last tax year, or estimates that he will have during the current tax year, income taxable at a highest bracket of at least 50%, or have a net worth of $60,000 or more. Certain states have established additional qualifications.

Colorado Energy Research Institute
2221 East Street
Golden, Colorado 80401
Request for Qualifications

The Colorado Energy Research Institute (CERI) is the state organization with responsibility to the legislative and executive branches of State government with data and information on energy-related issues. This is achieved, in part, through a program of contract research projects.
At this time, CERI proposes to sponsor research in the following areas:

- A review and analysis of the relationship of energy development and water use in Colorado.
- An analysis of the interactions between coal development and transportation alternatives in Colorado.
- Design a state energy developments information system.
- An analysis of the economic impacts of potential energy conservation policies in Colorado.
- An analysis of energy consumption patterns in Colorado.
- Development of a methodology to analyze the impact of Western energy development on the Denver Metro area.
- An analysis of the potential for reduced energy transportation costs from changes in state institutional and regulatory factors.
- Development of criteria for assessing the relative success of oil shale development in Colorado
- Enhancement of coal developments planning in Colorado.

If your organization is qualified to perform research in these areas, contact Pam Davis at CERI, (303) 279-2881, for an information package of project summaries and instructions for submitting qualifications.
CERI will accept requests for this information package only until 5 p.m., April 14, 1978. Qualification statements must be received at CERI's office no later than 5 p.m., April 24, 1978.

The publication of this research agenda does not constitute a commitment to fund any or all of the listed projects.

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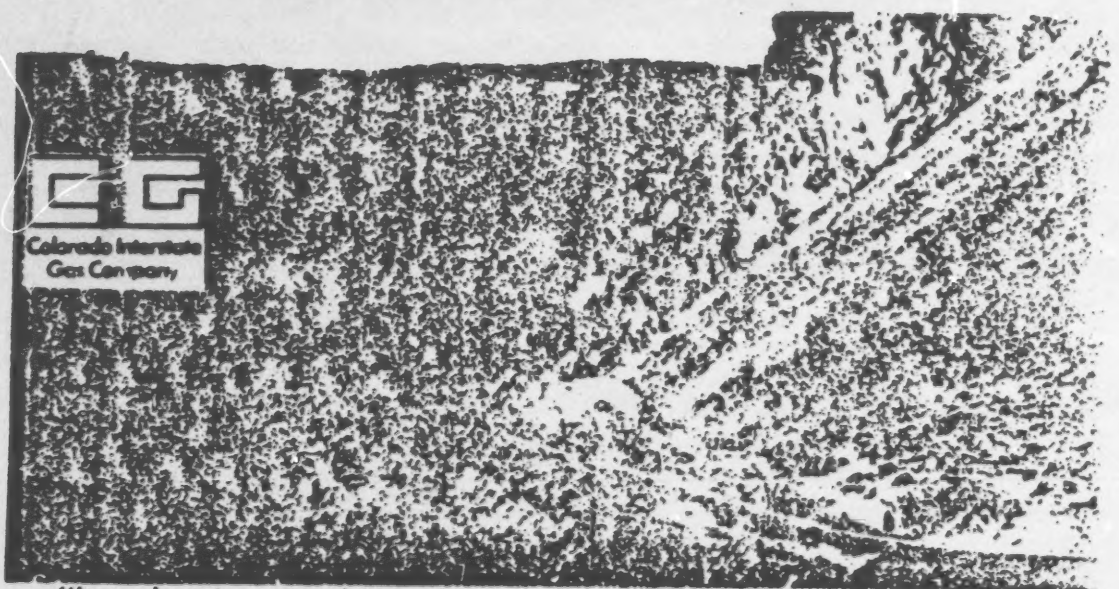
WE'RE GOING TO GREAT LENGTHS TODAY TO KEEP YOU WARM TOMORROW. AND THE DAY AFTER TOMORROW.



Shown here is our newly completed, 114-mile, 16-inch pipeline which will soon enable us to step up the flow of natural gas from the Madden Deep Field in Central Wyoming.

And we've embarked on another pipeline project – 115 miles of 24- and 30-inch pipeline in Wyoming and Colorado to complete "loop" lines extending from our Desert Springs Field in Southwestern Wyoming to Denver. Completion of this link is scheduled for the fall of 1978, in time for the 1978-1979 winter.

We're also installing new gas compression facilities on our Wyoming main line to help transport new gas supplies to market.

In addition, we've just completed a new "sweetening" plant adjacent to the productive Table Rock Field.

All these comprise an expansion program that will go a long way to assist in gathering, processing and moving the major new natural gas supplies being developed in Wyoming and elsewhere in the Rocky Mountain area.

Obviously, expansion like this is costly. But, it's well worth it, considering the role these facilities will play in bolstering the flow of natural gas to our customers.

And assuring you a continuous supply of this clean-burning energy. Tomorrow. And the day after tomorrow.

E19

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4 reasons for turning coal into gas at the mine

Traditionally coal has been used [illegible] electricity. This will continue to be [illegible] modern [illegible] new technique for using [illegible] environmentally [illegible]

1. It's extremely efficient in terms of capital investment.

A [illegible] is only half that required [illegible] The cost advantage is even greater [illegible]

2. It costs consumers less, too.

[illegible] electricity from coal [illegible]

3. It's environmentally clean.

[illegible] supply it releases [illegible] much water [illegible]

4. The pipeline system is there to deliver it.

There's a million mile network [illegible] pipelines already in place [illegible] deliver gas from coal to all parts of the country. Using that efficient, invisible delivery system as fully as possible is common sense [illegible]

Coal-derived gas can make [illegible] to our nation's energy supplies before the end of the next decade.

Conserve today's gas while we're getting tomorrow's.

AGA American Gas Association

E20

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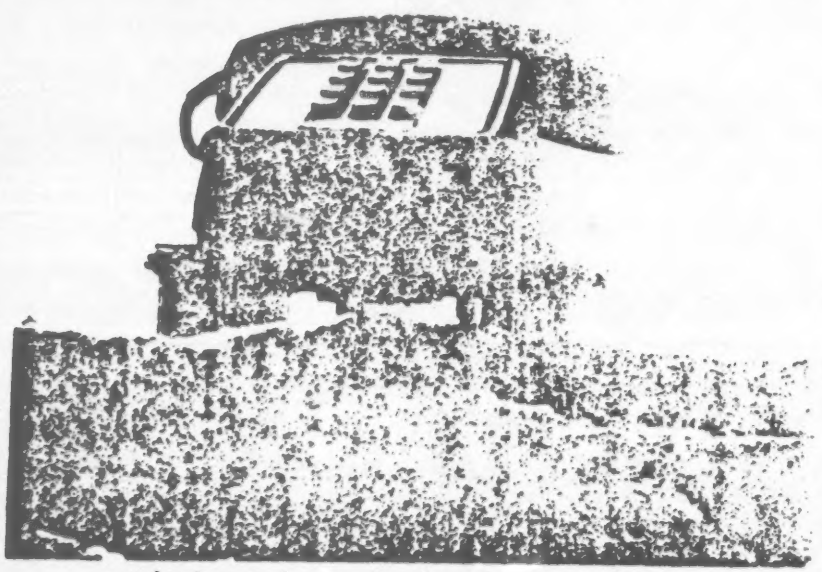
How the Bell System is pumping more service out of less oil.

In 1973, when the OPEC oil embargo went into effect, the Bell System committed itself to reducing its energy consumption. That commitment has been fulfilled. In four years, the Bell System has saved the energy equivalent of almost 24 million barrels of oil and over 415 million dollars in energy costs—savings that help hold down the cost of your telephone bills.

Today, the Bell System is actually using 11 per cent less energy than it did in 1973, even though the number of telephones in service has risen over 16 per cent and the volume of business has increased 33 per cent.



Here's how we are combining common sense with uncommon technology in four basic areas to achieve Zero Energy Growth.

Telephones are reconditioned three times.

The Bell System's energy needs begin with the power and fuel necessary to design and manufacture the basic communications components—cables, wire and equipment such as your home telephone.

In general, it takes much more energy to manufacture such items from scratch than it does to recycle them. Because Bell System equipment is designed by Bell Labs to be reliable, repairable *and* recyclable, extensive energy cutbacks have been realized through 40 years of recycling and reuse. New, more energy-efficient processes are constantly being devised by Western Electric, some of which entail modifying original designs for even greater materials and power savings.

Since 1974, the Bell conservation program has saved the energy equivalent of over three million barrels of oil by recycling metals. Also, more than six million equivalent barrels of oil have been saved through the reuse of equipment. The average telephone, for example, is reconditioned three times before it is unrepairable or obsolete.

New technology does more with less.

Another area in which the Bell System is effecting energy savings is in power for switching and transmission equipment. Constantly, new energy-saving technology is being added to the system. *Item:* Over two billion power-saving transistors, diodes and integrated circuits have been put into use. *Item:* Light Emitting Diodes (LEDs) are replacing incandescent bulbs in switchboards and telephones, saving over 90 per cent of the previously required power. *Item:* A new

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microprocessor called MAC-8 is less than one-tenth the size of a postage stamp yet contains the equivalent of over 7,000 transistors. The MAC-8 can execute several hundred electronic "thinking" functions, yet it will operate on only one-tenth of a watt of power.

Smaller vehicles power giant fleet.

Twenty-two per cent of Bell's energy requirements are in fuel for its fleet of over 170,000 vehicles, the largest privately owned and operated motor fleet in the world. Here, a number of commonsense procedures have been adopted: engines are carefully tuned for peak efficiency, smaller and more fuel-efficient vehicles are being used, and shuttle services have been set up between some company locations. In addition, New York Telephone Company is experimenting with nonpolluting, energy-saving electric-powered trucks. Due to these and other efforts, the Bell System in 1976 used over five per cent less motor fuel than in 1973.

Even employees' body heat is used.

Heating, lighting and air conditioning of Bell System's 25,000 buildings account for 45 per cent of its energy needs. Broad economies have been achieved simply by removing thousands of unnecessary lights; by lowering temperature settings; by cutting back on hot water temperatures; and by heating or cooling unoccupied areas only to the extent required for equipment operations.

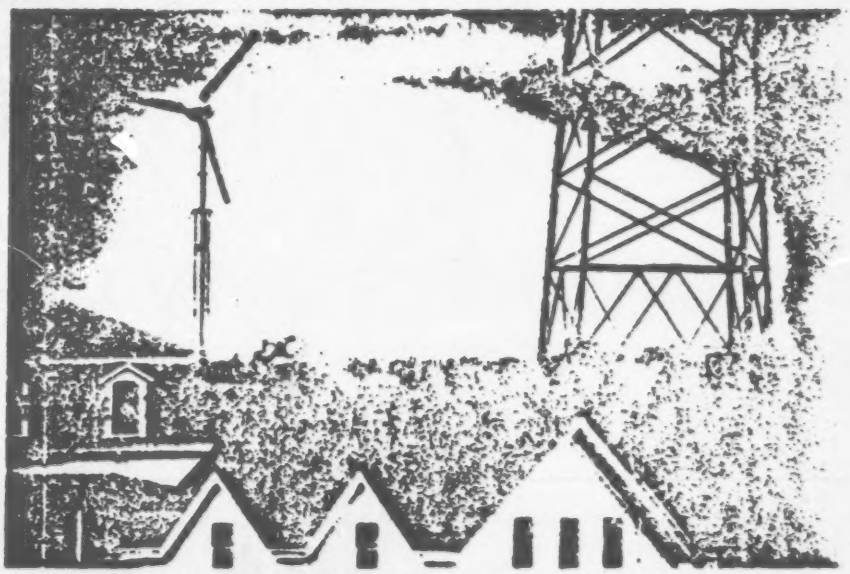
Moving beyond the obvious conservation measures, the Bell System created a building energy management program to redesign and retrofit existing buildings to improve their energy efficiency. Two examples of other power-saving programs at Bell facilities:

• On windy Block Island, Rhode Island, the New England Telephone Company began operating a wind dynamo in September, 1976. It can produce up to 15 kilowatts of electricity to power a central office and microwave radio terminal. Excess power from the windmill is fed back to the power company.

• In AT&T's new Basking Ridge, New Jersey, facility, an innovative computerized system heats about 1½ million feet of office space by recovering excess heat from the building environment—lights, equipment and the body heat of employees. It is estimated that the system uses 25 per cent less energy than conventional heating/cooling systems.

Bell trials of solar heating and cooling are providing valuable data which should lead to more widespread use of alternate energy systems.

Windmill helps power central phone office and microwave radio terminal (tower at right) on Block Island



Today, throughout the Bell System, our commitment to energy conservation is more than a goal; it is an ongoing reality. And in looking to the future, we anticipate that in 1982 we will still be using no more energy than was used in 1973. *Keeping your phone system the best in the world.*

Bell System

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You're in a race against time.

The race against time is a race for more electricity.

You'll need that electricity for your job and your home.

The race is on because some parts of the U.S. will face serious electrical shortages as early as the late 1970's.

As a result, we have to continue building new power plants, as rapidly as possible—because they take 8-10 years to complete.

We have to move swiftly, so that new offices and factories will have enough power to operate, and to generate new jobs. So that the job market will keep expanding along with opportunities for advancement.

You'll also need more power to benefit from all the electrical things to come. The electric car you'll drive. The electric buses and trains. And all of tomorrow's miracle labor-saving devices.

To make your electric future come true, construction must go on. Your electric company has the know-how, and is ready and willing to get the job done.

The sooner the better, for everyone. Because, if we don't do it now, time has a way of catching up with us.

The time to build power plants is now.

Edison Electric Institute
for the electric companies

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WHEN IT COMES TO SAVING ENERGY... SUMMER IS THE BEST TIME TO PREPARE FOR WINTER

And, that's particularly true of insulation. Summer is the best time of year to insulate your home for two very good reasons. First, because insulation is a heat barrier, it can make your home noticeably cooler in the summer by preventing the hot air that accumulates in your attic each day from seeping into your home and second, because summer is considered to be off-season; the waiting time to have attic insulation installed is usually much shorter. Public Service Company will be glad to help you determine whether or not you need insulation and if so, how much it will take to bring it up to an R-30 standard. This inspection service is free.

Use the handy coupon below, call 571-7721 or call your local Public Service Co. office.

Yes, I'd like to have a Public Service Company representative check my attic insulation.

Name .....

Address ..... City ..... Zip.....

Home Phone ..... Best time to call.....AM .....PM

Office Phone ..... Best time to call.....AM .....PM

Mail coupon to:
Public Service Company of Colorado
P.O. Box 840—Room 676
Denver, Colorado 80201

Public Service Company of Colorado

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WE'LL INSPECT YOUR ATTIC INSULATION FREE!

Even if you have plenty of insulation, we want to help you make sure. And if you need more insulation, we want to help you determine how much and what kind it will take to bring your insulation up to an R-30 standard.

And we want to do it free, because it's in your best interest and ours that you have the best possible insulation for energy conservation during the winter heating season and the summer cooling season.

What's more, if we determine that you need more insulation, we'll arrange for the contractor and we'll finance the cost, adding moderate payments to your utility bills. And we'll see that the contractor stands behind his work.

For an appointment with a Public Service Company insulation expert, call us.

There's no obligation to add insulation, and the inspection service is free.

call 571-7721 in Denver, or call your local P.S.C. office.

Public Service Company of Colorado

an investor-owned u' ty

c 1978 CTIR

As home heating gets more expensive, we must find better ways to insulate. Alcoa™ Insulated Windows are designed to help reduce unnecessary heat loss and save energy. Alcoa Insulated Windows have twin panes of welded-edge glass, aluminum-to-vinyl construction in both sash and frame, plus heavy-pile weather stripping. Flexible vinyl glazing eliminates chipping and the cost or inconvenience of periodic scraping and painting.

If your house is air-conditioned, Alcoa Insulated Windows will help reduce heat penetration in the summer. So you can save energy all year 'round.

Available in both new construction and replacement units, Alcoa Insulated Windows offer a low-maintenance, energy-saving alternative to ordinary uninsulated windows.

Fortunately, Alcoa began to develop these special windows long before energy supplies became an issue. As a result, we have them today when we need them more than ever.

For more information on Alcoa's Insulated Windows, write Aluminum Company of America, 600-D Alcoa Building, Pittsburgh, PA 15219.

ALCOA

Today, Alcoa's Insulated Windows can help reduce the heat loss in your home.

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E26

ENERGY COSTS

CONSERVE IT...

Save on water costs with new water-saving faucets and fixtures

LET US REMODEL YOUR KITCHEN AND BATH

we'll install:

- New water-saving kitchen faucets
- Water saving tub, lavatory faucets
- Toilets that use less water
- Energy-conserving water heaters

plus many other new money saving ideas

DESIGN AND PLANNING SERVICE
FREE ESTIMATES

VISA

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Plumbing • Heating • Air Conditioning

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WORRIED?

by high gas & electric bills?

BUILDING?

WOOD WINDOWS AND PATIO DOORS

CARADCO BODVILL

HIGHEST QUALITY—LOW PRICES

*wood . . . for warmth and charm

WINDOWS INCORPORATED

1610 Wynkoop St.
Denver, Colo. 80202 825-2881

*Wood insulates 1,770 times better than aluminum

5% ENERGY SAVINGS COUPON 5%
Extra discount of 5 PER CENT

On all orders placed with us during 1978 with CASH IN ADVANCE at the time the order is placed. Present this coupon with your order. This offer is void where coupons are taxed, regulated or prohibited.

WINDOWS, INC. 825-2881
1610 WYNKOOP, DENVER, COLO. 80202

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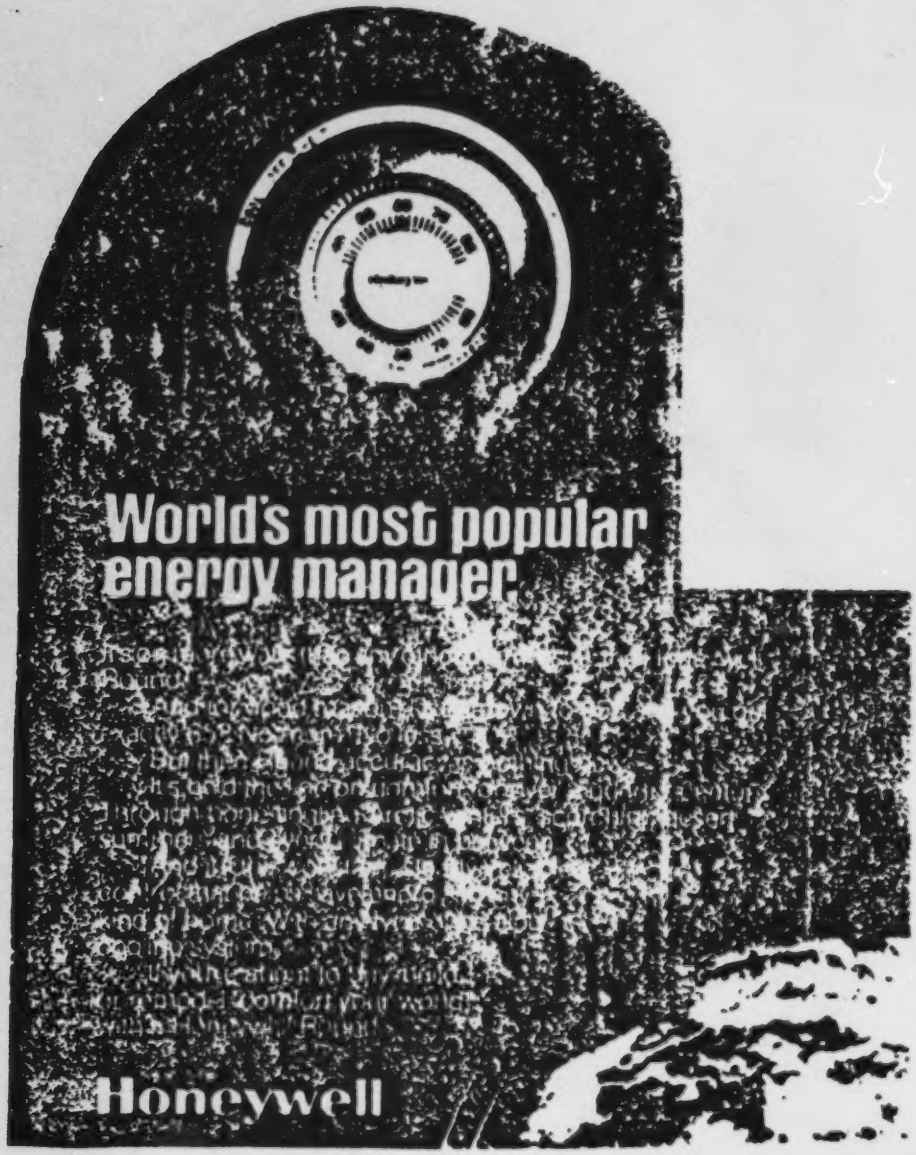


E28

c 1978 CTIR

"I think my Sunstream solar water heating system is a great investment." Annie L. Crawford

Annie Crawford has joined the growing number of homeowners who enjoy immediate savings with Grumman Sunstream™ solar domestic water heating systems

Savings are considerable, because the hot water an average family of four uses for showers, washing clothes and dishes can be more than 27,000 gallons each year! The cost of heating this water can amount to 15% to 40% of your yearly heating bill

The Grumman Sunstream system is an investment that will pay increasing dividends as conventional energy costs continue to rise

Sunstream is a product of Grumman technology, which landed Americans on the moon

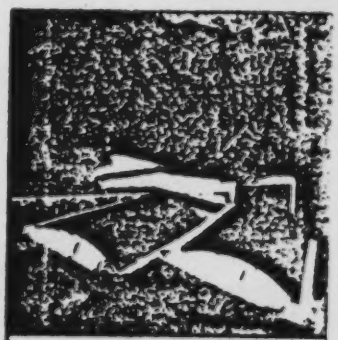
Grumman stands for reliability in Gulfstream executive jets, Grumman trucks, canoes and Pearson yachts

Prices on Grumman Sunstream systems start at $1,238, plus transportation, local taxes, and dealer installation

For more information on domestic water, space and pool heating, write Grumman Sunstream, Dept 201, 4175 Veterans Memorial Highway, Ronkonkoma, New York 11779

GRUMMAN Sunstream™

The reliable source



Sunstream collectors on the Crawford home in California

c 1978 CTIR

HOW FAR CAN YOU GO ON A GALLON OF GAS?

Junior High and Senior High

Objectives:

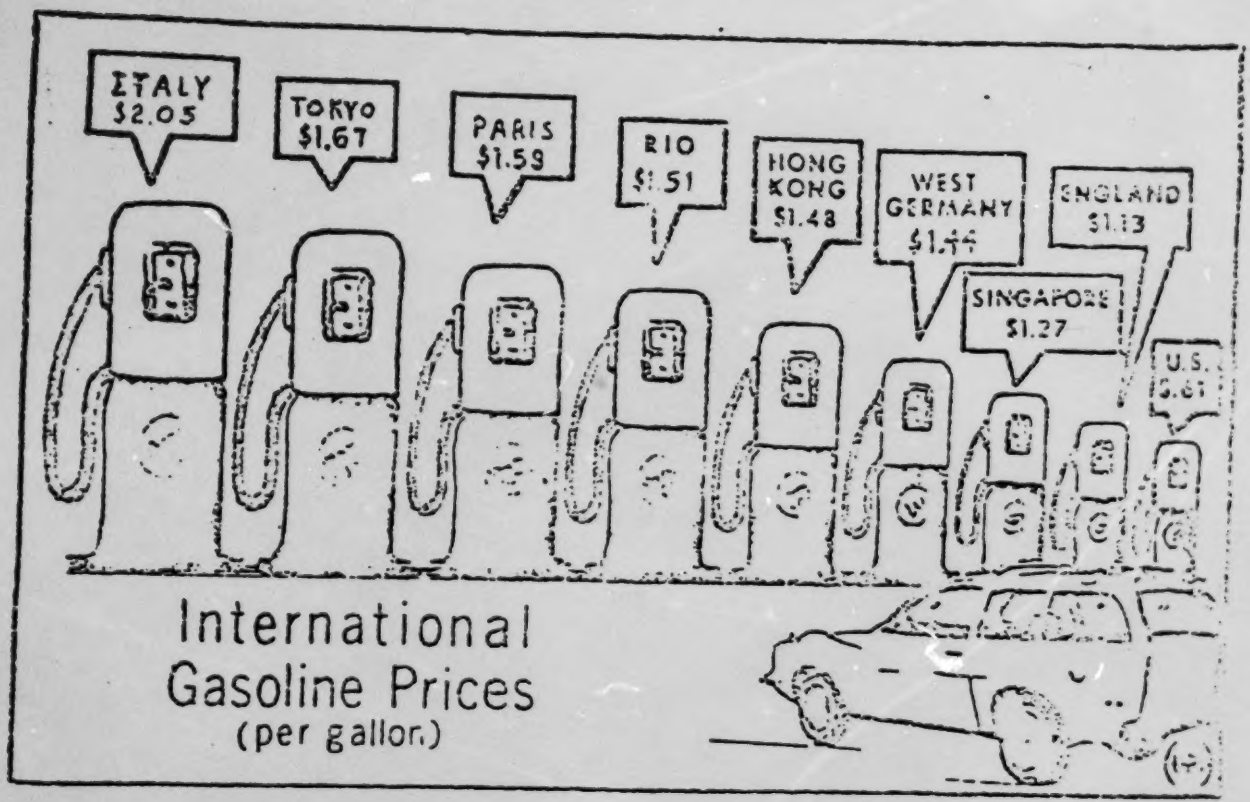
1. Students will select at random an international gas price and a car.
2. Students will be given mileage to a city in their state. (City 200 to 250 miles away.)
3. Given $8.00, the distance to the city they are visiting, and the M.P.G. of their car, the students will compute how far they could get on the money.
4. Students will draw conclusions about how travel is affected by gas prices.

Materials Needed: Nine cards with gas prices in other parts of the world, and thirty cards with a car and it's M.P.G. Any car dealer can give you a booklet with the E.P.A. mileage for all cars. (The cars listed here give the combined city and highway M.P.G. as listed in the 1979 Gas Mileage Guide.) For copies of the booklet, write: Fuel Economy, Pueblo, Colorado 81009.

Procedure: Have the students draw car and gasoline price cards. This could be done individually or in pairs. All students have $8.00 to spend and a fixed number of miles to travel. Using the M.P.G. for their car, have them figure how far they can go on their country's gas prices. (Divide $8.00 by the gas price; then multiply that by the car's M.P.G.). On a large map, students could mark the distance they were able to travel towards their destination, or have them report to the class how far they were able to travel in their car.

After all students have completed their own statistics, give the class a copy of the compared gas prices and the car M.P.G.'s and discuss the following questions:

1. How do gasoline prices in your hometown and in the U.S. generally compare to other parts of the world?
2. How would your driving habits be affected if you lived in Rome?
3. What is the relationship between gasoline prices and cars that people buy? How would this relationship vary from the U.S. to Japan to Italy?
4. What is the relationship between gas prices and the amount of gasoline consumed? What conclusions can you draw about U.S. gasoline consumption?
5. What else besides the gasoline prices might affect the kind of cars people buy?



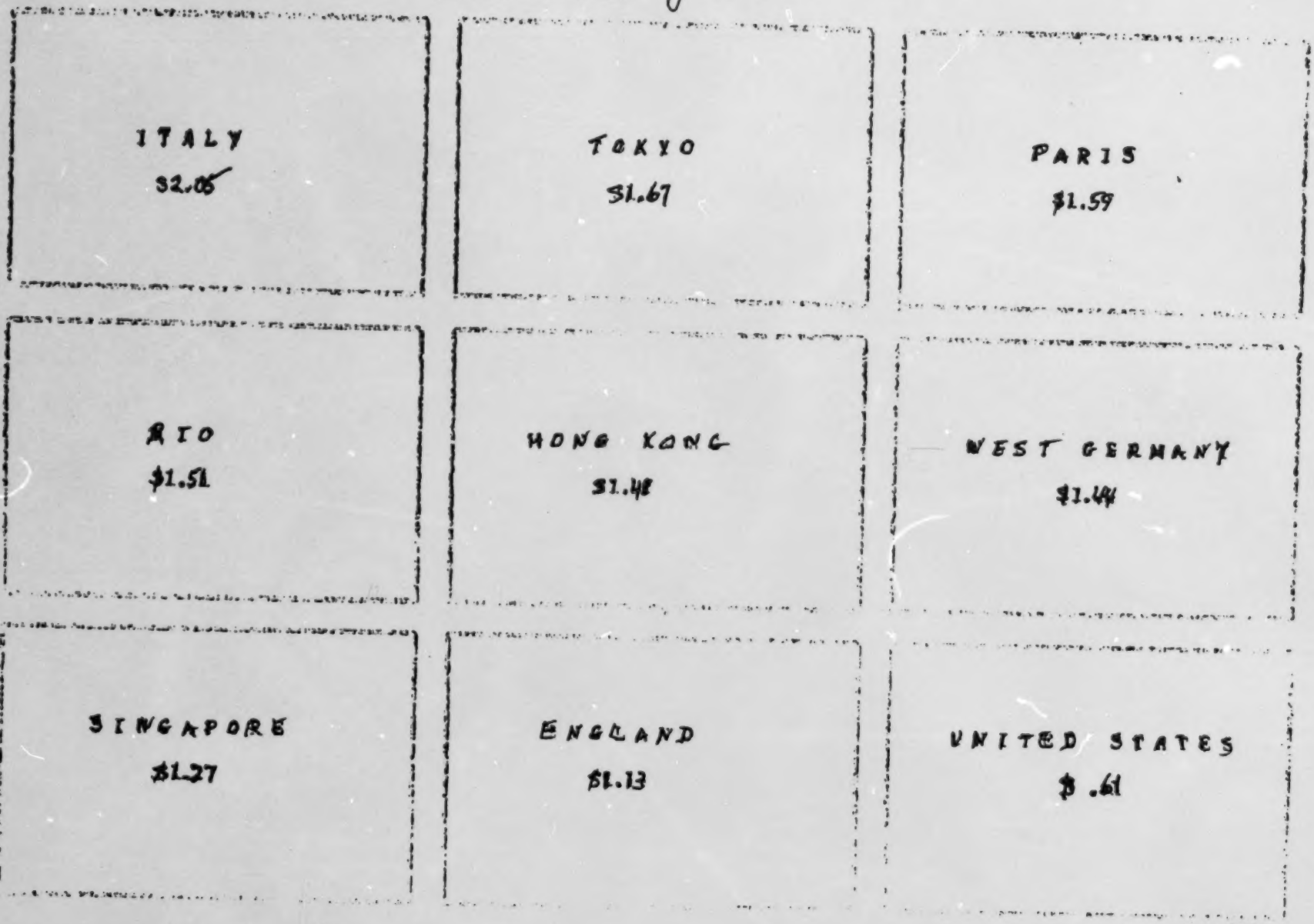
International Oil Developments, Statistical Survey, Jan. 22, 1976.

FUEL RATINGS IN M.P.G. FOR 1979 VEHICLES
(From left to right: the model, automatic or manual transmission, and mileage.)

1. Datsun B-210 m - 28 MPG
2. Mustang II m - 21 MPG
3. Plymouth Sapporo m - 26 MPG
4. AMC Spirit m - 22 MPG
5. Chevrolet Camaro m - 15 MPG
6. Chevrolet Monza m - 24 MPG
7. Ford Fiesta m - 28 MPG
8. Toyota Celica m - 18 MPG
9. VW Dasher m - 23 MPG
10. VW Rabbit Diesel m - 41 MPG
11. AMC Pacer a - 17 MPG
12. Chevrolet Nova m - 19 MPG
13. Dodge Omni m - 25 MPG
14. Cadillac ElDorado a - 14 MPG
15. Chrysler Cordoba a - 16 MPG
16. Ford LTD II a - 14 MPG
17. Olds Cutlass Salon a - 24 MPG
18. Pontiac Grand Prix a - 17 MPG
19. Buick LeSabre a - 17 MPG
20. Lincoln Continental a - 12 MPG
21. Olds Delta 88 a - 18 MPG
22. MGB m - 16 MPG
23. Ford Pinto Wagon m - 20 MPG
24. Plymouth Volare Wagon a - 16 MPG
25. Ford LTD Wagon a - 13 MPG
26. Datsun Pickup m - 21 MPG
27. Chevrolet Monte Carlo a - 19 MPG
28. GMC Pickup m - 19 MPG
29. Ford Econoline Van m - 17 MPG
30. Honda Civic m - 28 MPG

INTERNAT[illegible] GASOLINE PRICES

International Gasoline Prices



E32

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ONE SMALL PIZZA

Introduction:

Few students would turn down a pizza, but how to divide it among 30 classmates can conplicate things. This activity just might pass their tolerance level as students examine the inequities in the distribution of energy resources on a global (classroom) level. Alternative methods of distribution are presented to students as they wrestle with the issue, "How to slice the pie."

Objectives:

At the conclusion of this activity, students should be able to:

- assess alternative methods of distribution of global energy resources
- identify those methods of distribution that are currently in practive, citing reasons for each method
- speculate about global inequities and energy resource distribution
- articulate about the complexity and difficulty involved in distributing energy resources equitably.

Materials:

hungry students
6" pizza
(optional) 10 grocery bags, felt pens

Procedure:

1. Place the following question on the board:
   "How should energy resources be distributed?"

   At the teacher's discretion, this activity can be introduced in one of two ways:

   Dramatic Presentation: Place a small pizza on a student's desk. Obtain 10 grocery bags. Draw a face on each bag. Place one of the proposals (listed below) in each bag. "Introduce" each "candidate" to the class, reading his/her proposal for allocating world energy resources.

   A second method is to list the proposals given below on the board with the question, "How sould energy resources be distributed?"

2. Regardless of the method selected, students should pick an alternative for the distribution of global energy resources.

   This can be an individual task during which students "vote" for a candiate (proposal), or teachers may choose to divide the class into small groups to promote student interaction.

NOTE: Watch out! Some students may become too frustrated, waiting for a decision on who will get the pizza. Such frustration may be exhibited by "stealing" and/or "eating" the pizza in full view of the rest of the class. If this oc rs, the implications for debriefing the activity are many. HOW LONG CAN DEVELOPING NATIONS WAIT FOR ANSWERS TO ENERGY ISSUES?

Debriefing Ideas:

1. Given the state of world energy resources, which proposal(s) do you think are totally unfeasible? Why?

possible responses: #2-If resources were divided equally, no nation would get the energy resources it needs. #3-Its too late. The rainy day has arrived.

2. Given the state of world energy resources, which proposal(s) do you think explain our current global energy situation? Defend your answers.

possible responses: #1 OPEC's prices. #4 Depending on students perceptions, "high grades" may be interpreted as "technology #5 Other students may interpret technology as "hard work." #7 Foreigh aid and investments can be viewed as "contributions," providing a rationale for consumptive patterns among developed nations. #8 Since we've already developed, we're "first in line." #9 Using the Middle East, perhaps this proposal can be justified.

3. Given the state of world energy resources, which proposal(s) would be the most difficult to implement? Defend your answers.

possible responses: #4,5,6,7. Reaching consensus on criteria such as "high grades," "hard workers," "neediest," and "contributors" is a difficult task.

4. Which methods(s) of distribution seem the most equitable? Which seem the least equitable?

   (Responses will vary)

5. Which method(s) do you think could lead to conflict?

possible responses: #8-wars; #1-Developing nations might get fed up with being "out-priced." #9-Hoarding resources could lead to conflict.

Extending Learning Ideas:

1. As a research project, have students obtain the data necessary to translate the "pizza" into a circle graph, illustrating consumptive patterns among world areas.
2. Students could become "campaign managers" urging support for candidated representing each proposal.
3. Set up a role-reversal. How would a Nigerian, Indian or Brazilian respond to each proposal?
4. Allow students to select and prove how one or two of the proposals are in practice today. This option requires further research.

PROPOSALS

HOW SHOULD ENERGY RESOURCES BE DISTRIBUTED?

1. Sell to the highest bidder.
2. Divide equally among all of us.
3. Save for a rainy day.
4. Give to the people with the highest grades.
5. Award to the hardest workers in class.
6. Give to the neediest people in class.
7. Award to the people who have contributed the most to class.
8. First come, first serve.
9. Give it to the person whose desk it is on.
10. Give it to the strongest, person in class.

Note: Students may develop "write-in" candidates advocating different proposals.

This activity is adapted from, "Apples," Center for Teaching International Relations, University of Denver. Credit for the original activity is given to Jerry McCracken, Metroplitan State College, Denver, Colorado.

Distortions! Distortions!

Introduction:

Sometimes the visual impact of "distortion maps" can make a point better than words. In this activity, students are shown a world map that distorts the areas of the world where most energy resources are located. Students can test their geography skills, identifying India, Nigeria and Brazil on this map. They are then asked to "make a hunch" about where most of this energy is consumed.

A discussion on distribution of energy resources and how it is related to global interdependence concludes this activity.

Objectives:

At the conclusion of this activity students should be able to:
- -locate India, Nigeria and Brazil on three world maps
- -identify areas of the world where oil reserves are found and areas where oil reserves are consumed
- -define global interdependence

Materials:

3 maps (duplicate one set per group)
1) blank world map
2) Global Oil Reserves
3) (students develop own title; should resemble something like, "Global Consumption.")

Procedure:

1. Divide class into small groups. Distribute the first world map to each group. Students should complete the assignment given on map 1. (5-10 minutes)

2. Distribute the second map to each group. As they answer the questions on this map, some should express shock at the large size of Nigeria and the small size of India. Ask them to speculate why this is so. Probe them further to make hypotheses about which nations might have to import or export oil.

3. Next, ask students to speculate about what a consumption map might look like.

   Optional: Distribute a blank world map and felt pens for students to display their hypotheses. Let them make some "hunches" in their groups, creating their own distortion maps. These hunches can be compared later when students receive map 3.

4. Finally, distribute map 3, encouraging students to compare maps 2 and 3 as they locate India, Nigeria and Brazil.

Experimental material from the Project for an Energy Enriched Curriculum, NSTA, Boulder, Colorado, 1978.

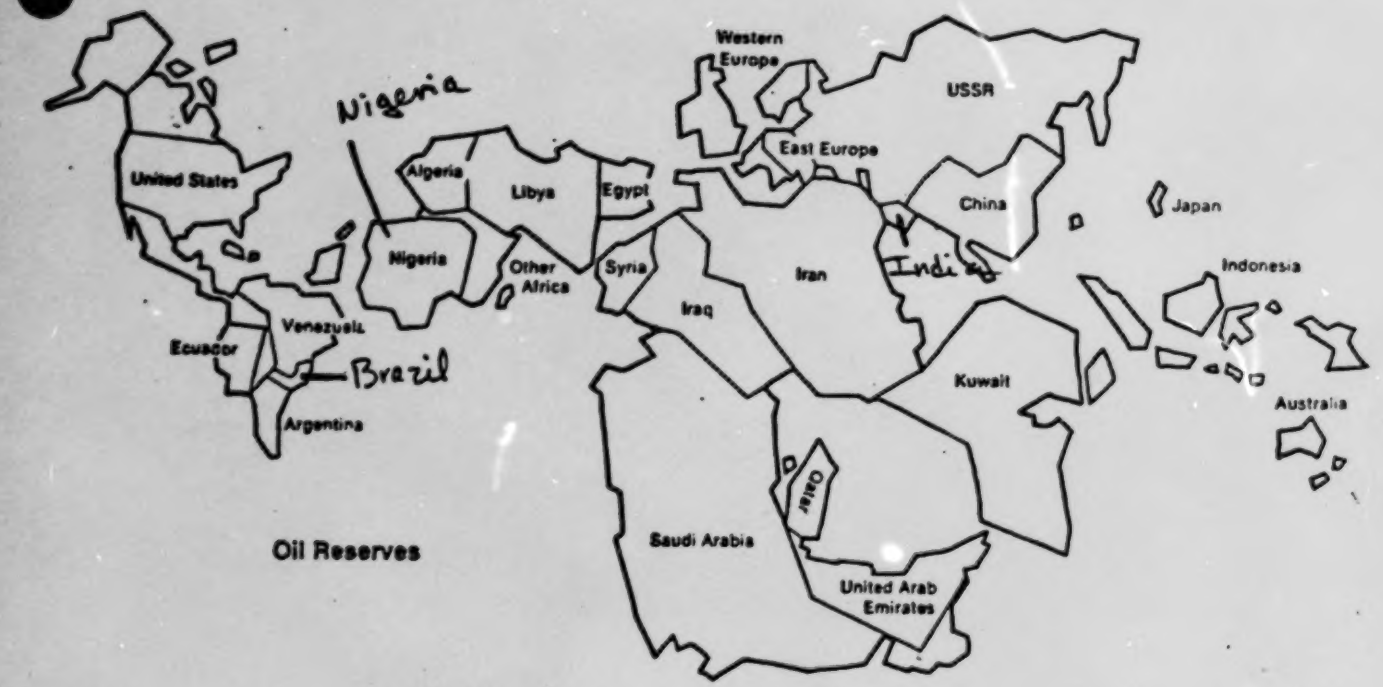
Debriefing Ideas:

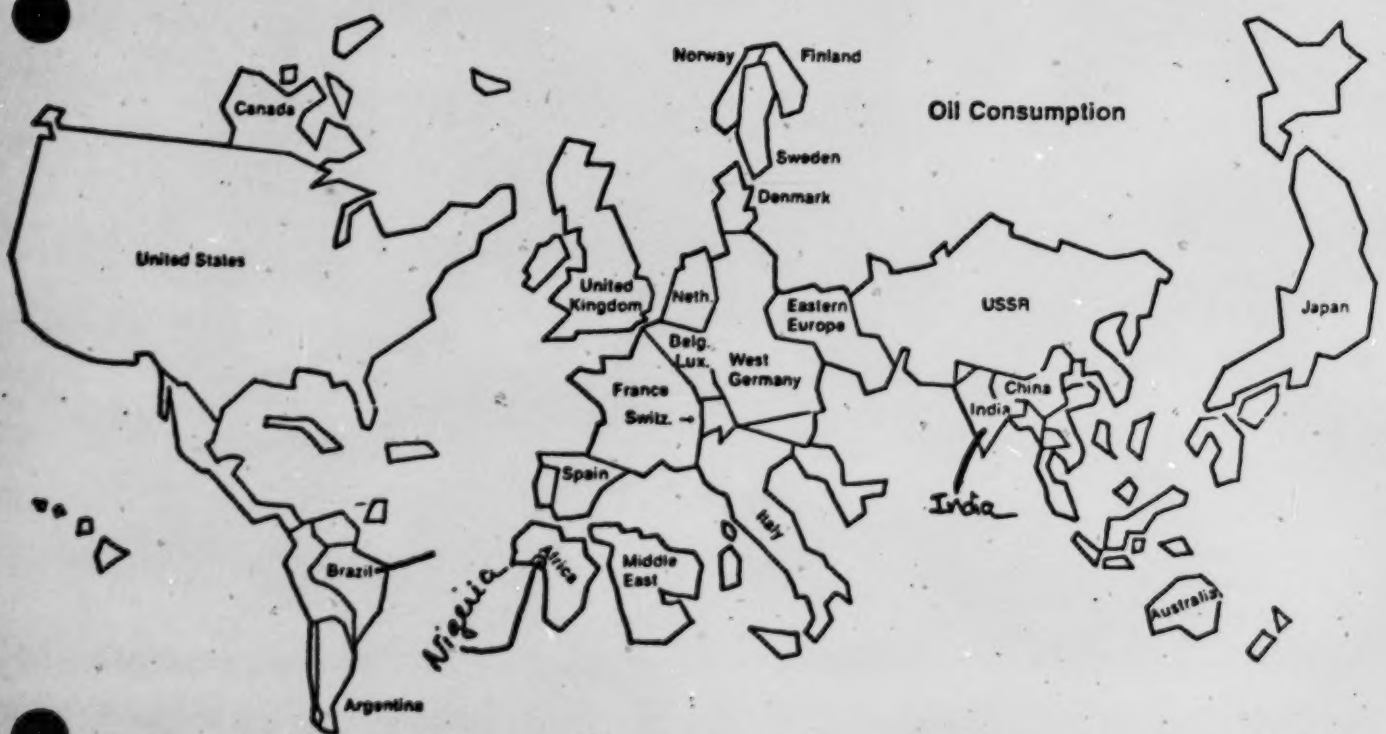
1. Using all three maps, define global interdependence.
2. What does interdependence have to do with the current energy situation?
3. Use these maps to explain the following statement:

> "The average American consumes 19 times more energy than the average person in Brazil, 62 more times than the average person in India and 188 times the average Nigerian."

TEACHER COPY

DISTORTIONS! DISTORTIONS!

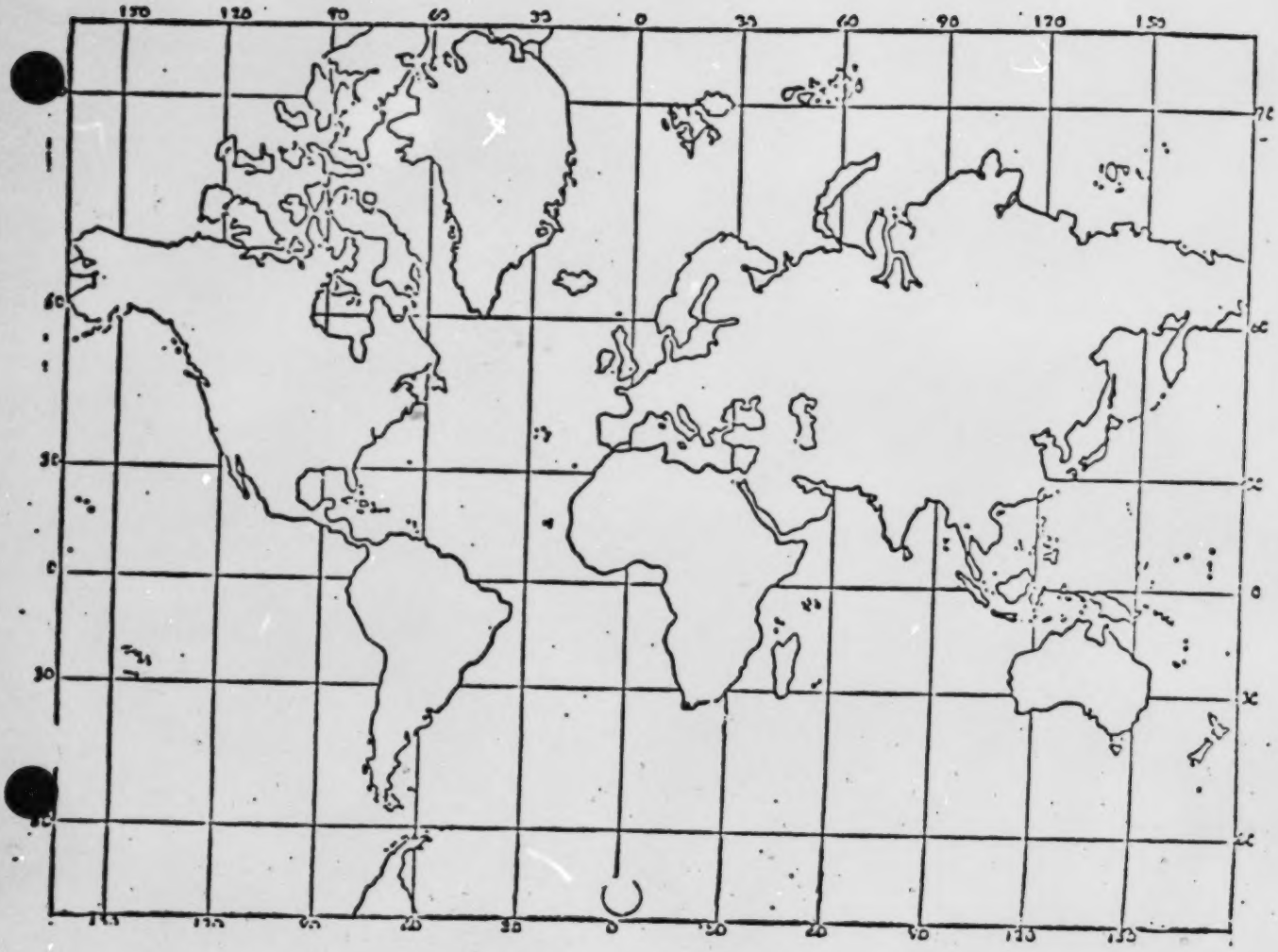




Maps from *The Tricentennial Report: Letters From America* (1977), courtesy Atlantic Richfield Company.

From Intercom 89, Global Perspectives through Asian Experiences, by Betty Bullard and Loretta Ryan, Guest Editors.

MAP 1.

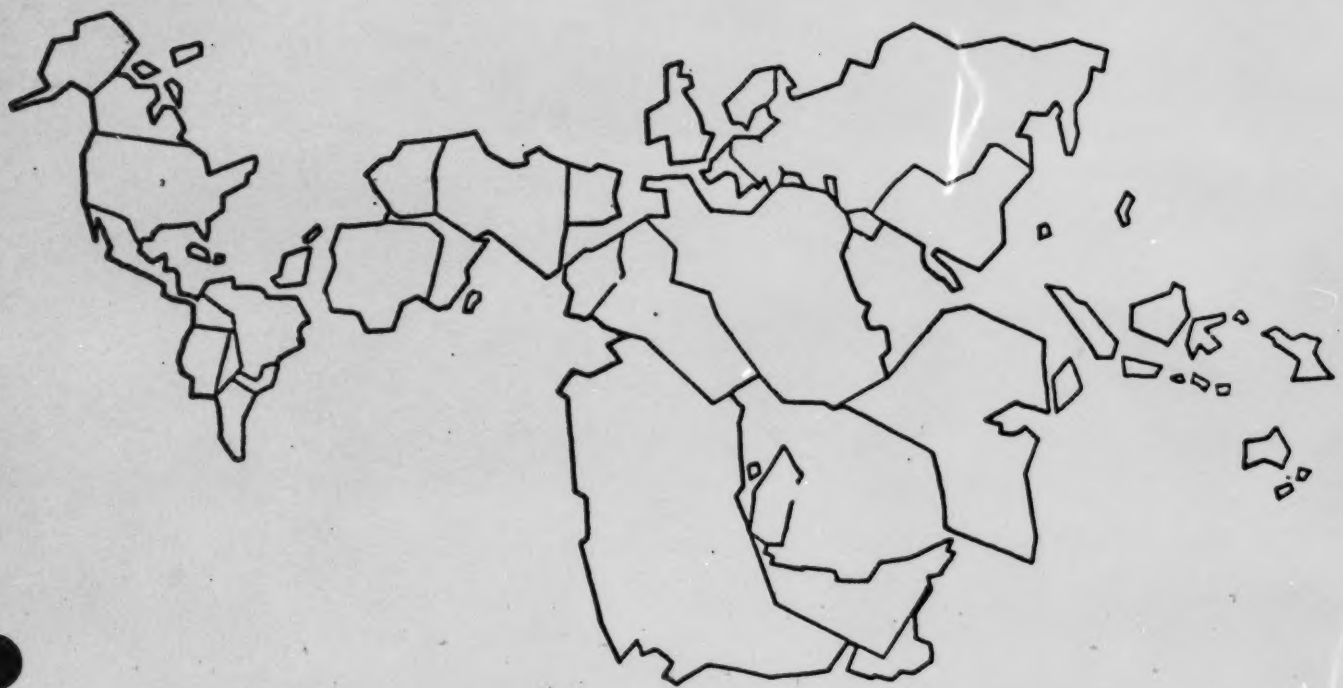


Locate India, Nigeria, Brazil and the United States.

Circle the following world areas:

North America
Latin America
Middle East
Africa
Asia

MAP 2 GLOBAL OIL RESERVES



Find India, Nigeria, Brazil and the United States on this map.

Which area of the world is distorted to become oversized?

Which area of the world is distorted to become very small?

Which nation that we have studied could probably export oil? Why?

Which nation will probaly have to import oil, especially if this nation develops this same way the United States developed? Why?

MAP 3 _____

Find India, Nigeria, Brazil and the United States on this map.

List as many nations or world areas that you can that are distorted to become oversized.

Why are they distorted in this way?

List as many nations or world areas that you can that are distorted to become much smaller.

Why are they distorted in this way?

Give this map a title.

I'LL DOUBLE THAT!

Overview

This lesson is intended to reinforce the concept of exponential growth and to give students concrete experiences in applying the concept to energy. Given statistical data, students will develop a set of graphs which will illustrate the importance of the variable, increase over present consumption. "Doubling time" will be illustrated as the entire class develops a large bulletin-board size graph of U.S. Oil Consumption. And they will sharpen critical thinking skills as they examine and try to "debunk" misleading statements in advertisements on the present energy situation.

Objectives:

The student should be able to:

1. Define and calculate doubling time.
2. Graph statistical data.
3. Apply the concept of exponential growth to energy production and consumption, using statistical data.
4.

Time Allotment: 2 class periods

Materials:

(Identifed with activities)
Activity 1 "The Facts, Please"
Activity 2 "I'll Double That"

Experimental material from the Project for an Energy Enriched Curriculum, National Science Teachers Association, Boulder, Colorado, 1978. Packet developer: Jacquelyn Johnson, Cherry Creek (Colorado) Schools.

ACTIVITY 1: THE FACTS, PLEASE

Materials:
student worksheets:
"The Facts, Please: Coal"
"The Facts, Please: Oil"

Time Allotment: one class period

Procedure:

1. Present students with the data sheet on coal for Activity 1, "The Facts Please: Coal." Have them graph the data in the space provided for this exercise. (Teacher graph provided.)

2. Ask: "As the rate of consumption of coal increases, what happens to the number of years remaining?" (The number of years decreases. We have a shorter amount of time before our entire coal supply is depleted.)

   NOTE: Make sure students understand the relationship between the variable on the horizontal axis (percent increase over present consumption) and the number of years remaining.

> ..."Experts estimate that America has enough coal reserves to last 320 years at present levels of consumption making the energy crisis seem a political crock at best... It is true that America's coal reserves would last 320 years at present rates of consumption. However, the policy of the U.S. Government is to achieve rapid growth of coal consumption. If coal reserves will last 320 years at present rates of consumption, the life expectancy for various rates of growth of consumption are given in the table. (See student data sheet.)
>
> Dr. Albert A. Bartlett
> Department of Astrophysics
> University of Colorado
> (Quoted in the Colorado Daily, August 9, 1978.)

3. Distribute second worksheet, "The Facts, Please: Oil." Use the same procedure for this worksheet. Students will interpret data to construct a bar graph. (Teacher graph provided.) The bar graph will illustrate the number of years remaining as the U.S. consumption of oil increases. Students will find it helpful to reflect on their own ages as they calculate the

life expectancy of U.S. petroleum at different rates of consumption.

NOTE: Call students' attention to remaining U.S. petroleum supplies and mention the fact that these estimates are based on assuming the maximum potential of Alaskan oil and U.S. oil shale.

STUDENT DATA SHEET: THE FACTS, PLEASE.

COAL

HIGH estimate of remaining reserves
1486 billion Metric Tons

LOW estimate of remaining reserves
390 billion Metric Tons

Let's work with the MIDPOINT of the high and low estimates
950 Billion Metric Tons

Graph the data in the table on the left. Make the vertical axis the years remaining and the horizontal axis the percent increase over present consumption rates. Be sure to give your graph a title.

TITLE _____

Percent increase over present rates of consumption	How long will our coal last?
0 percent	320 years
1 percent	143 years
2 percent	100 years
3 percent	79 years
4 percent	66 years
5 percent	57 years
6 percent	50 years
7 percent	45 years
8 percent	41 years
9 percent	39 years
10 percent	35 years

Source: Albert Bartlett, Physics Dept., University of Colorado.

OIL

GONE
(USED UP)

95.6 BILLION BARRELS

LEFT

206.8 BILLION BARRELS
(Assuming maximum potential of Alaskian Oil and U.S. Oil Shale)

Make a bar graph in the space provided. Make the vertical axis the years remaining and the horizontal axis the percent increase over 1972 consumption. Be sure to give your graph a title.

Percent increase over 1970 Production and Consumption	Years Remaining
0%	63 years
1%	49 "
2%	41 "
3%	53 "
4%	31 "
5%	23 "
6%	26 "
7%	24 "
8%	22 "
9%	21 "
10%	20 "

STUDENT DATA SHEET: THE FACTS, PLEASE.

What year? ___ How old will you be? ___

What year? ___ How old will you be? ___

What year? ___ How old will you be? ___

What year? ___ How old will you be? ___

What year? ___ How old will you be? ___

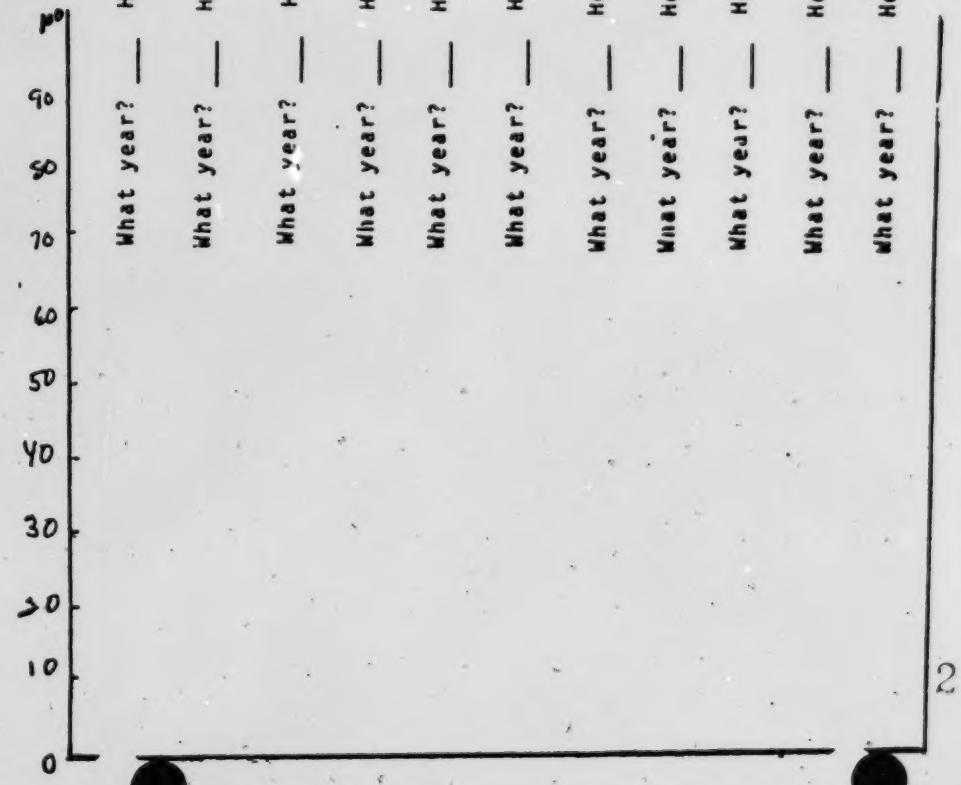
What year? ___ How old will you be? ___

What year? ___ How old will you be? ___

What year? ___ How old will you be? ___

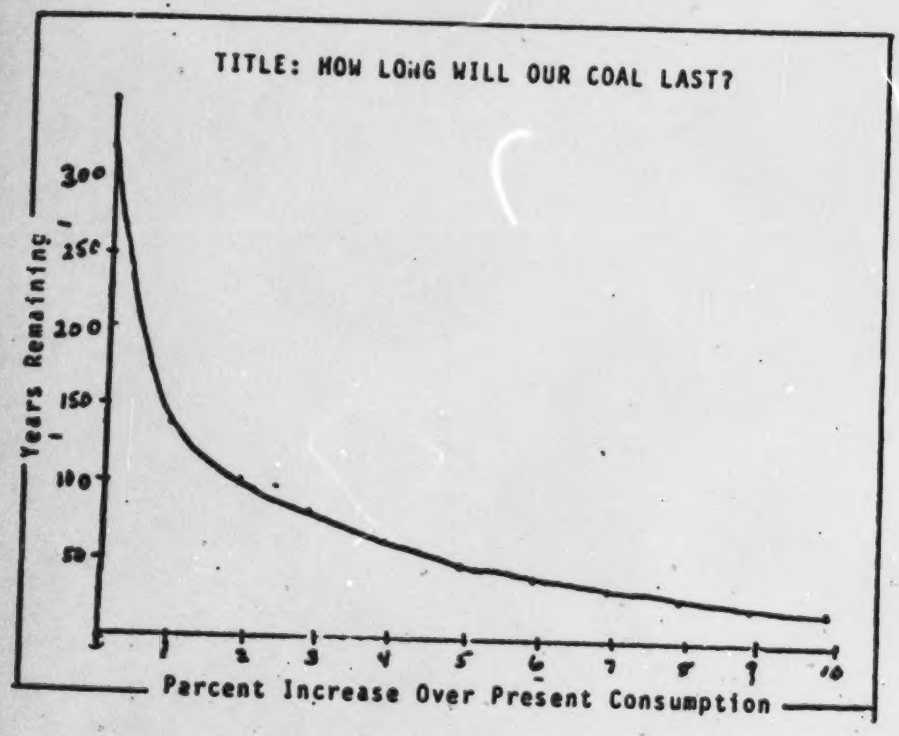
What year? ___ How old will you be? ___

What year? ___ How old will you be? ___

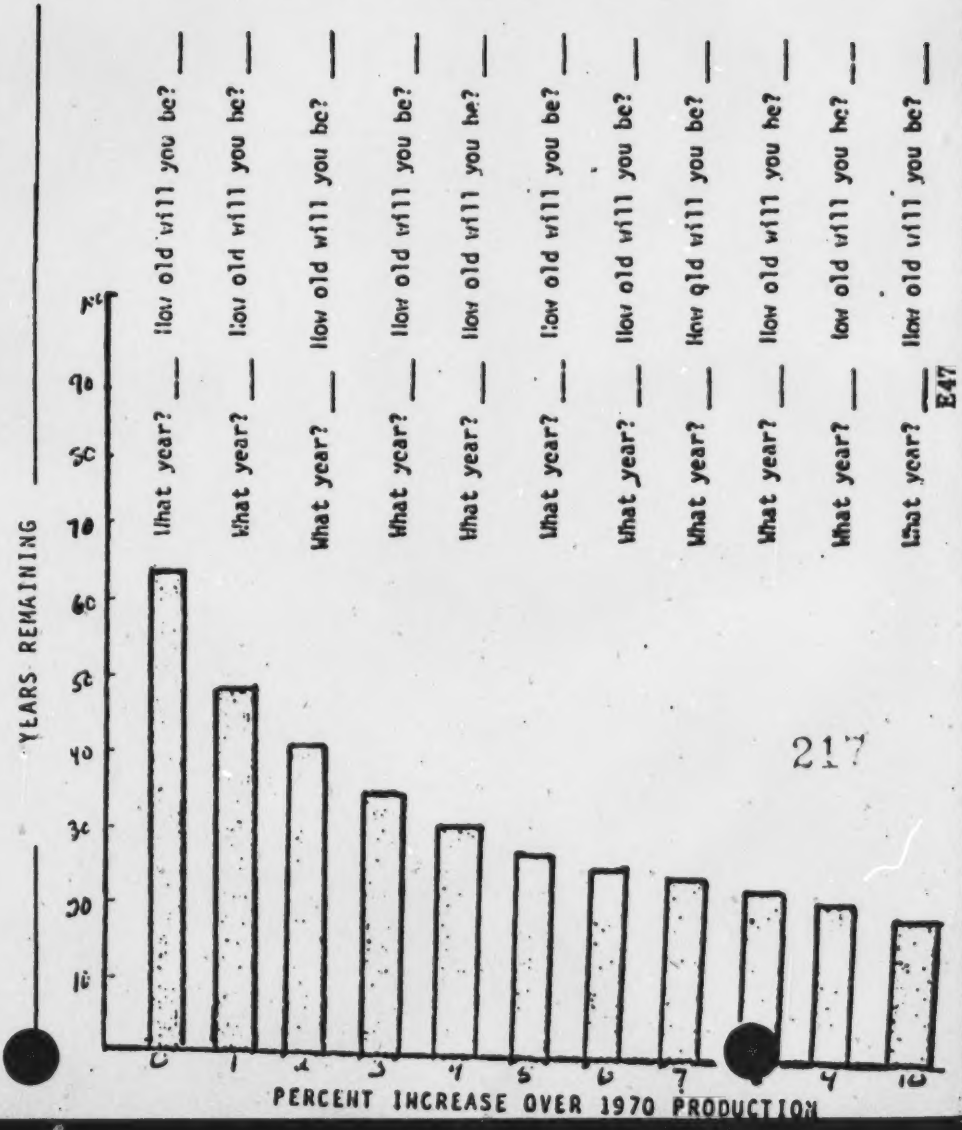


E46

Activity 1
Teacher Illustration



Activity 1
Teacher Illustration



ACTIVITY 2: I'LL DOUBLE THAT!

In this activity, students manipulate squares on a large graph (histogram) and demonstrate exponential growth. After calculating a doubling time of one decade for U.S. oil consumption, they should understand that <u>when things grow exponentially, enormous increases in resources are consumed in a very short time</u>.

<u>Materials</u>:

wall space the size of a bulletin board (or use a classroom door)
butcher paper
construction paper cut into 60 one-inch squares
thumb tacks
marking pens
overhead projector
copies of histogram: <u>U.S. Consumption of Oil, 1910-1980</u>

<u>Time Allotment</u>: 2 periods

<u>Procedure</u>:

1. Cover large bulletin board or classroom door with butcher paper. Project the histogram (provided in packet) on the overhead projector, focusing it on the bulletin board or door. Have students use marking pens to trace the histogram in the lower left corner of the wall or door space. (Projected size can be either the original size or double the original. If data is projected to original size, one-inch construction paper size should be used. Use two-inch squares if projected histogram is doubled.)

2. Ask students to identify the point on the graph that represents 1980 projected estimate of U.S. consumption of oil. (7 billion barrels per year) What was oil consumption in 1978? (6.8 billion barrels.)

3. Next, students should fill in the areas on the histogram, using cut out squares. Allow students to cut some of the squares to do this part of the activity.

   Ask students what the squares represent. They should be able to verbalize that the squares represent all the oil consumed in the U.S. from 1910 to 1980 (projection).

4. Tell students that our consumption of oil is growing at a rate of 7% per year (estimate). Have students calculate

the doubling time for our consumption of oil, using the following formulas.

$$\frac{\text{rate of growth}}{70} = \text{doubling time} \quad \text{OR} \quad \frac{7\%}{70} = 10 \text{ years}$$

5. Ask students how far the horizontal axis needs to be extended to accommodate the calculated doubling time? (10 years) Using a marking pen, have a student extend the horizontal axis on the histogram to 1990.

   This step will make the concept of doubling time very visual. Students now move the squares (representing our oil consumption from 1910-1980) and place them in the space that now represents 1990. All the squares previously used representing all the oil consumed in the U.S. must now somehow "fit" into the ten year period, 1980-1990. In other words, the amount of oil that we will need in 1990 (at current growth rates) will be equal to all the oil we have ever used! See illustration #1.

   To check the accuracy of their work, students can multiply the number of barrels they used before (7 billion barrels) by 2.

6. Calculate another doubling time, using the same procedure outlined above. Remember now that all the squares on the histogram have to somehow "fit" into this new 10 year period. Allow students to manipulate the squares once again. Carry out this procedure until the entire class has acquired a "feel" for doubling time and exponential growth.

   To illustrate an exponential curve, have students plot points in the center of the top square for each decade. Connect the points in a smooth curve. (See teacher illustration #2.)

Evaluation:

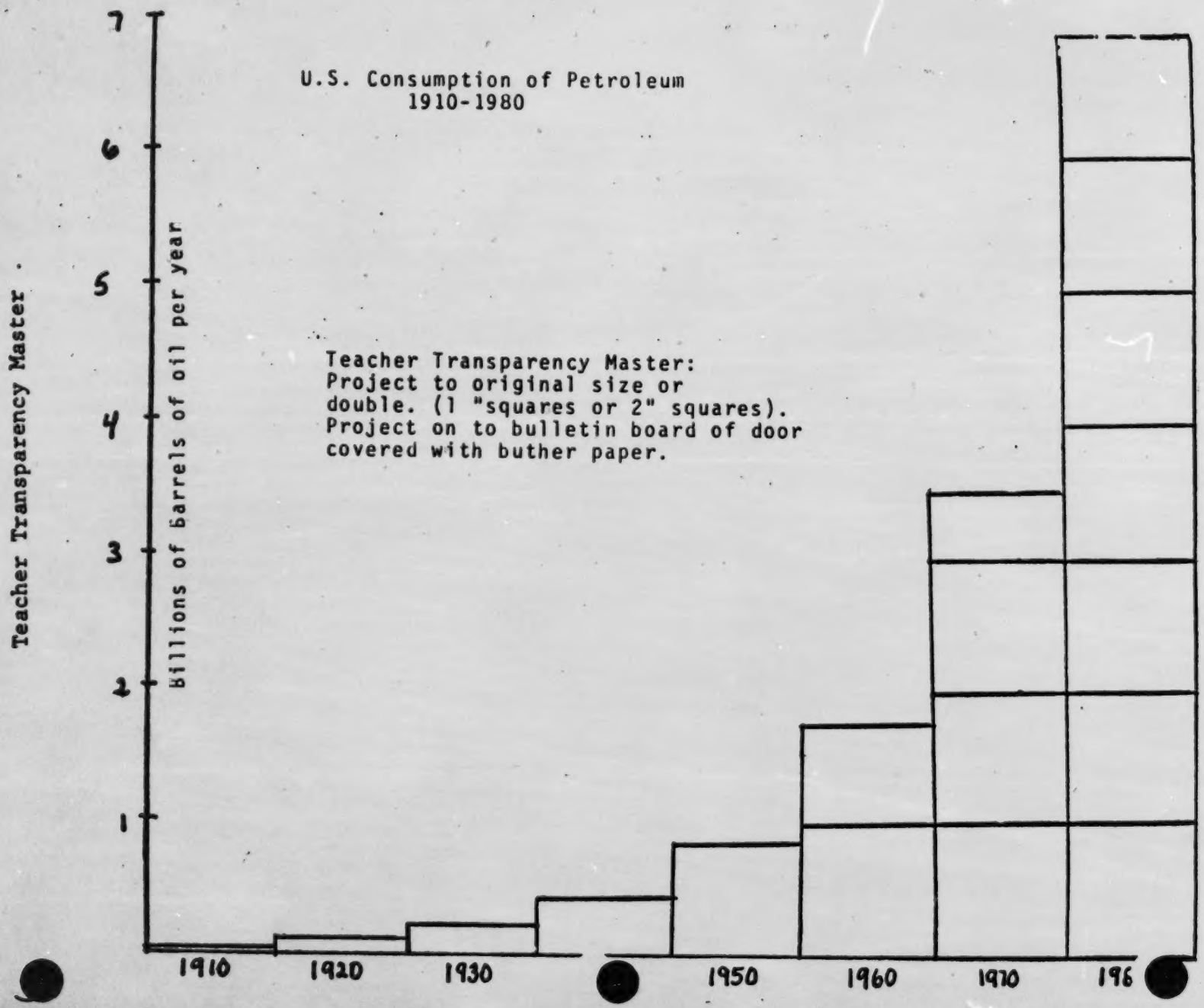
Write on the board or distribute to students the "bogus" newsrelease below. Students are required to apply what they have just learned about doubling time and exponential growth in evaluating the newsrelease.

How many students think this news will end the energy crisis? How long will this "discovery" fill our needs at current growth rates? Do students now have a "feel" for exponential growth?

...UPI...2000
Oil has been discovered in Anartica. This discovery is equal to all the oil consumed by the U.S. -- EVER! It appears that the energy crisis is over! U.S. Energy Officials are elated. Said one, "We've got oil coming out our ears!" This is indeed a wonderful day for the people of the United States.

Allow students to refer to the class histogram. At current growth rates, all the oil consumed in 2000 will equal all we've ever known. This "discovery" would accommodate our consumption needs for one more decade. WHEN THINGS GROW EXPONENTIALLY, ENORMOUS INCREASES IN RESOURCES ARE CONSUMED IN A VERY SHORT TIME!

Teacher Transparency Master



Teacher Transparency Master:
Project to original size or double. (1 "squares or 2" squares).
Project on to bulletin board of door covered with buther paper.

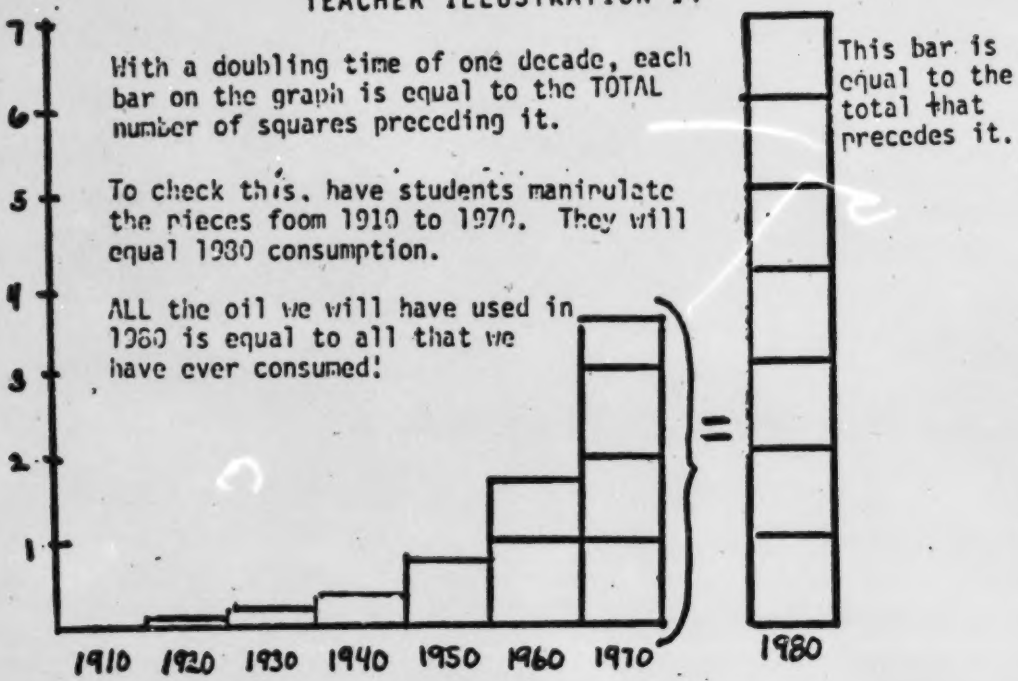
E51

TEACHER ILLUSTRATION #1

With a doubling time of one decade, each bar on the graph is equal to the TOTAL number of squares preceding it.

To check this, have students manipulate the pieces from 1910 to 1970. They will equal 1980 consumption.

ALL the oil we will have used in 1980 is equal to all that we have ever consumed!



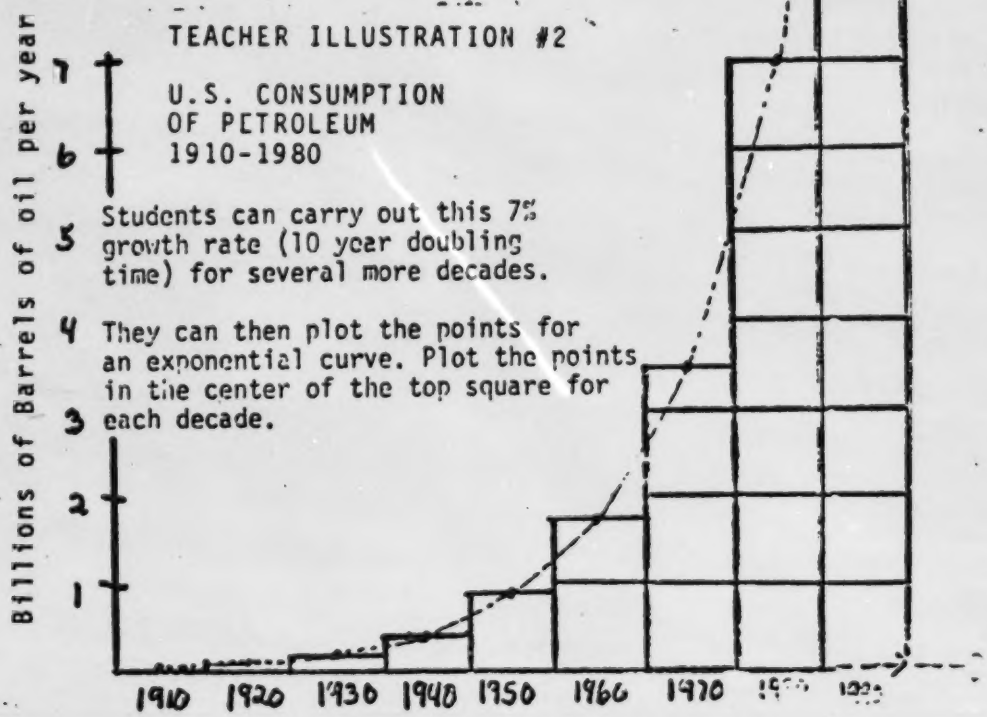
This bar is equal to the total that precedes it.

TEACHER ILLUSTRATION #2

U.S. CONSUMPTION OF PETROLEUM 1910-1980

Students can carry out this 7% growth rate (10 year doubling time) for several more decades.

They can then plot the points for an exponential curve. Plot the points in the center of the top square for each decade.



OTHER USES OF THIS MODEL:

Using this format, teachers may choose to develop their own "felt boards." Students may also enjoy using this model to develop their own projects that visually display the concept of exponential growth. Such projects can then be used in discussing other growth rates and energy resources.. Contact paper, though not easily removed can also be used with this model.

E52

Title: ENERGY RIGHTS

Introduction: Americans are the greatest consumers of energy. We consume more than half of the world's energy. Do we have a responsibility toward the rest of the world's people? This activity gives students a chance to think about the "rights" we have as energy consumers.

Objective:

To give students a chance to evaluate their rights as compared to others.

To let students examine the consequences of the "rights" they want to have.

Grade Level: 7-12

Time: One hour

Materials: Handout, "Rights"

Procedure:

Step 1. Distribute one copy of the handout to each student.

Step 2. Have students individually circle the number of those rights they want to have.

Step 3. Share students' selections and choose five "rights" they most value.

Debriefing:

1. Can students have all the rights? Are there contradictions among the rights?

2. Are there other rights related to energy students would like to include?

3. Would an environmentalist answer the same way that students did?

4. Do students feel that they can currently enjoy those five rights they most value? Are there obstacles to having them? Do students feel that they will be able to enjoy the same rights five years from now? What problems, if any, do they foresee?

Patricia A. Heist

5. What role does the government have in guaranteeing that we have these rights?

6. Are there pressure groups that influence what rights we have available to us?

7. Who determines what rights we will be able to enjoy?

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RIGHTS

Every American should have the right to:

1. Have a dishwasher, trash compactor, washer, dryer, freezer, and any other appliance he can afford and might want.
2. Have as many children as he wants and can afford to support.
3. Build a wind generator in the backyard even if the neighbors think it's ugly.
4. Commute to work on a bicycle in safe bicycle paths. (Reserved for bicycles.)
5. Own a car and drive it whenever and however much he wants.
6. Own and drive a Winnebago or large camping trailer on vacation (if that is what he wants and can afford).
7. Observe and enjoy wildlife in its natural state.
8. Own a large speedboat and dune buggy for recreation.
9. Be assured (guaranteed) that any new house purchased will have maximum insulation and energy-saving features.
10. Live in a community that has preserved much of the beauty of natural surroundings.
11. Be free from exposure to unsafe substances in food.
12. Camp and hike in unspoiled wilderness.
13. Ride down a wild river.
14. Have access to cheap, convenient, reliable, mass transit systems in cities.
15. Have unhampered access to use of the sun for home heating. (Sun shining on your house can't be blocked by neighbors.)
16. Be safe from the possibility of misuse of nuclear materials by terrorists or from radioactive poisoning from nuclear accidents in power plants.
17. Have a fire in your own fireplace whenever you want.
18. Buy any kind of car he wants and can afford.
19. Breathe clean unpolluted air and drink clean water.
20. Travel a long distance on vacation every year.

E55

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RIGHTS (cont.)

21. Use as much gasoline, natural gas, and electricity every year as he can afford.

22. Enjoy the convenience of throw-away cans and bottles.

23. Eat as much meat in his diet as he likes.

24. Set the thermostat at whatever level he feels is comfortable.

25. Choose the type of heating he will have in his home. (gas, electric, wood, fuel oil, solar)

26. Live in a single family dwelling, own his own home.

27. Be educated in a carpeted classroom.

28. Take as many baths or showers as they want.

29. An equal amount of energy to expend as they wish.

30. Always get a free drink of water.

31. Have a vegetable garden that puts a strain on existing water supplies.

32. Oppose construction of highways and bridges that would change rural areas to urban areas.

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Title: ENERGY DEADLINES

Introduction: This activity asks students to share thoughts about priorities of the social problems facing humankind.

Objectives:

To rank major problems concerning energy and the environment.

To sort out which problems might be of a more immediate nature than others to solve.

Grade Level: 7-12

Time: 45 minutes

Materials: Transparency Master, "Deadlines"
Transparency overhead projector, screen

Basic Skills Focus:

A. Data interpretation and analysis

B. Group discussion (especially concensus decision making)

C. Values clarification

Procedure:

Step 1. Make a transparency from the master sheet. Project the transparency on the screen.

Step 2. Divide the class into groups of four to five students.

Step 3. Each group is to rank order all eight of the items according to what the group members consider to be the most important deadline to meet, the second most important deadline, and so on.

Step 4. Each group must come to a concensus on priorities. If groups cannot achieve concensus on a particular deadline, have them find out what the majority would decide and the person who disagrees may issue a "minority report."

Gary R. Smith. Adapted from an activity by George G. Otero, Jr., Acting Director, Center for Teaching International Relations.

Debriefing:

1. How are the deadlines interconnected? That is, how is one deadline dependent upon meeting another deadline?

2. How do the priority lists of the various groups in the room compare with each other?

DEADLINES

Number in order of the importance of finding a solution to the following energy and environmental problems.

_____ Control nuclear arms

_____ Establish alternatives to oil and fossil fuels

_____ Curb population growth

_____ Develop widespread use of solar energy

_____ Do away with urban sprawl and congestion

_____ Eliminate air pollution

_____ Conserve all needed nonrenewable resources

_____ Make certain that endangered species of animals do not become extinct, such as whales, elephants, and tigers.

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Title: TRENDS

Introduction: People, in general, act in predictable patterns. Changes in our society occur slowly. Given these facts, we can assume that certain trends are going to continue. This activity gives students a chance to evaluate energy trends.

Objectives:

To give students a chance to examine the negative and positive trends related to energy.

To have students relate their actions to energy trends.

Grade Level: 9-12

Time: One hour

Materials: Handout, "Trends"

Procedure:

Step 1. Distribute one copy of the handout to each student.

Step 2. Have students check those trends they feel will occur.

Step 3. Have students categorize *trends* into *Good, Bad, Undecided.*

Debriefing:

1. Are there trends listed that students feel will not occur? Why?
2. Do students feel they have the power needed to do anything about the trends that they listed in the *Bad* column? What would have to occur to reverse any or all of the *Bad* trends?
3. Do certain groups hold the power for change? What groups?
4. Are there trends listed which will create a greater separation between the "rich" and the "poor"?
5. How do students feel about living in the year 2000 if these trends continue?

Patricia A. Heist

TRENDS

Trends assumed most likely to continue through 1985 and in high probability to 2000:

- ☐ Overall population will continue to increase.
- ☐ Rate of population growth will continue to decrease in developed regions and more and more developed regions will arrive at net zero population growth.
- ☐ Per capita energy demand and use will continue to rise.
- ☐ Production of goods and services will continue to increase.
- ☐ Energy conversion inventions will continue to proliferate.
- ☐ Fossil fuel reserves will continue to diminish and costs continue to rise.
- ☐ Lag between invention and implementation of energy technology will continue to decrease.
- ☐ Technology will continue to do more with less; energy input per unit of output will continue to decline.
- ☐ State-of-the-art energy conversion efficiency will be used.
- ☐ Existing energy converters will be replaced by more efficient energy converters as they become obsolete and/or worn out.
- ☐ Energy conversion technology will continue to decentralize and miniaturize.
- ☐ Large power plants will continue to grow in size.
- ☐ Income energy sources will be increasingly used.
- ☐ Discovery of new types and sources of energy and power conversion will continue to increase.
- ☐ Impact of energy system on the ecological context will continue.
- ☐ World mobility and use of energy for transportation will continue to increase.

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Trends (continued)

☐ World cooperation and globalization of institutions in regard to energy will increase.

☐ Coordination and standardization of tools and contact (end use) products regarding energy will increase.

Other Assumptions

☐ Total energy and per capita energy consumption cannot continue to increase forever; energy use will reach a steady state in this century or shortly thereafter.

☐ Viable alternatives must be technologically feasible before they are economically feasible.

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Step 6. Ask the students which world they think we will have. Why?

Step 7. Which world would they prefer? Why?

Step 8. What do students think would need to be done to have abundant energy 50 years from now?

Title: ENERGY USES OF THE FUTURE

Introduction: One of two possible worlds awaits us in the future 50 years hence: a world with abundant energy or one in which energy is scarce. This activity gives students a chance to imagine what the world will be like 50 years from now.

Objectives:

To imagine what the world will be like in terms of energy 50 years into the future.

To write a story of the future.

Grade Level: K-6

Time: One class period

Materials: Pencils and paper

Procedure:

Step 1. Discuss what the students have heard about energy shortages and the use of power and energy in our society.

Step 2. Ask them to think about what the world will be like in 50 years if the energy crisis continues and worsens. Then have them imagine what the world will be like if the energy problems are solved (say, by solar uses) and energy is abundant.

Step 3. Divide the class into two groups. Have one group write stories about the world in 50 years with abundant energy. Have the other group write about a world 50 years from now with a critical energy shortage. It might be best to have them write about one day in the life of a person of their present age, or a person of the age they will be in 50 years.

Step 4. Kindergarteners and first graders may draw pictures rather than write stories, or the stories could be dictated to be written by older children, the teacher, or aides. Or, one story contributed to by members of the group could be written on the chalk board or a large piece of paper.

Step 5. Read the stories aloud and compare ideas from the two groups.

Gary R. Smith

Culmination Activities

Title: ONE THING LEADS TO ANOTHER

Introduction: Interdependence is a concept fundamental to the understanding of energy problems. As indicated in other activities in this volume, "things ramify," they have consequences. This simple exercise asks students to draw lines between phrases that are in some way related to energy and environmental concerns.

Objectives:

To recognize the interconnections of energy and environmental problems and issues.

To diagram how these issues interconnect.

Grade Level: 6-12

Time: One class period

Materials: Handout, "Interconnections"
Handout, "A Wheel"

Basic Skills Focus: A. Values clarification

B. Reading and interpreting graphs

Procedure:

Step 1. Distribute a copy of "Interconnections" to each student.

Step 2. Students may draw lines or arrows connecting the various phrases. The idea is to show, by use of the lines and arrows, how one problem, concern, issue, or phenomenon leads to another.

Step 3. Ask students to volunteer to hold up their diagrams and explain how they come up with their lines (arrows) and diagrams. In other words, how did students create their diagrams?

Step 4. Distribute copies of "A Wheel" to students. Ask students to discuss and compare their drawings with the fortune wheel.

Gary R. Smith

INTERCONNECTIONS

NOTE: More than one line may be drawn to any of the items.

MORE POLLUTION	MORE DEAF PEOPLE
MORE BUILDINGS	MORE DIRTY AIR
MORE HUNTERS COMING BACK	LESS WATER
MORE DEATHS	LESS GAS
MORE NOISE	LESS HUNTERS
MORE FACTORIES	MORE HEARING AIDS
MORE CARS	MORE DROUGHTS
MORE PEOPLE	MORE TIME FOR ANIMALS TO GROW
LESS ANIMALS	LESS TREES

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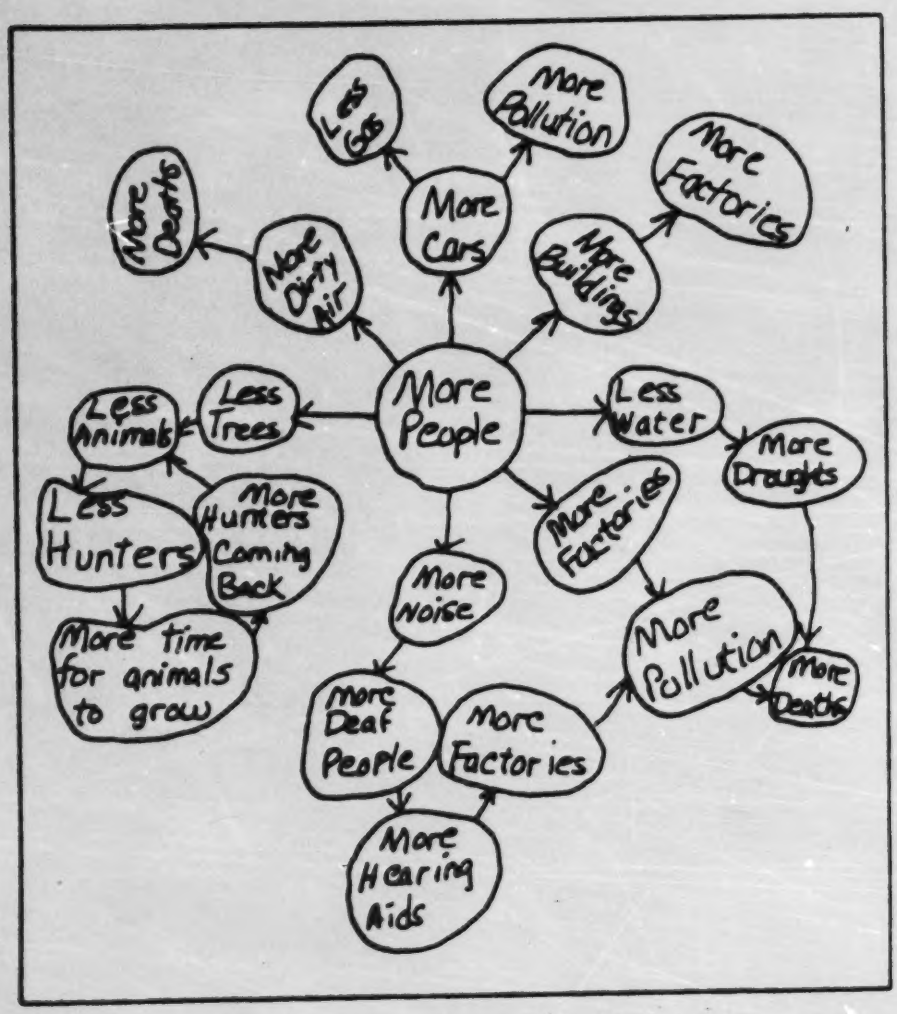
FUTURE WHEEL*



*From Growth Implications and the Earth's Future, Education Development Center, Newton, Mass., p. 79.

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Title: PROBLEMS, PROBLEMS

Introduction: In the process of becoming consciously aware of energy issues, students need some exposure to the dynamics of how problems and solutions are interrelated. Many times people see solutions but fail to realize the consequences of those solutions. When a solution is proposed and implemented to meet a problem, new problems may arise from the solution itself. This activity asks students to think about possible consequences when turning to solutions to meet technological problems.

Objectives:

To recognize how technological solutions can have consequences.

To recognize that a solution may not be an answer.

To recognize the principle of interdependence.

Grade Level: 7-12

Time: 45 minutes

Materials: Handout, "Consequences"

Procedure:

Step 1. Have students list problems that are connected with energy.

Step 2. Distribute copies of the handout to students.

Step 3. Divide students into groups to discuss possible solutions and consequences. Have the groups fill in the chart.

Debriefing:

1. For which problems were students able to find solutions?
2. Would there be any difficulty in carrying out those solutions?
3. Are the consequences worth the solution?

Gary R. Smith

4. Were there problems which had no apparent solution?

5. Did everyone in your group agree on problems and/or solutions?

CONSEQUENCES

PROBLEM?	SOLUTION	CONSEQUENCES
Example: Outdoor Plumbing	Flush toilet Sinks and drains	Waste treatment, use of a lot of water, etc.
1. Traffic congestion		
2. Water shortage		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		

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Title: Yes, No, or Maybe (by George Otero)

Introduction: Many potential changes can affect one's opinion of population changes. In fact, many changes are suggested by various groups every day. Some suggest we farm the sea and grow more food. Some suggest we concentrate on slowing the birth rate. There are pros and cons for every suggested change. In this activity students document and/or recognize the pros and cons for proposed changes relating to population changes. In addition, the participants discuss their preferences and opinions about the likelihood and desirability of these changes.

Lesson Objectives:

1. To document positive and negative implications of proposed changes that could affect population growth or food production.
2. To recognize and verbalize personal preferences and evaluations concerning population-related predictions and possibilities.

Mechanics:

Time: 1 or 2 hours for research
1 class period for discussion

Materials: Duplicate copies of the handout titled "Yes, No, or Maybe."

Activity:

Hand out the ditto titled "Yes, No, or Maybe." Tell the group to complete the worksheet based on the knowledge they have. (Time can also be given for research if that is needed). Go over the questions on the worksheet with the participants.

YES, NO, OR MAYBE

Below are suggested future approaches and changes related to population and food issues.

Give an argument for each suggestion and an argument against each suggestion.

a. farming the sea

b. irrigation of arid (dry) lands with desalted sea water

c. sending excess people to colonize other planets

d. voluntary family planning

e. addition of contraceptives to drinking water

f. increased use of fertilizers and pesticides

g. clearing and farming tropical rain forests

h. abortion on demand

i. taking care of our own country first; letting the rest of the world go its own way

Questions:

1). Which suggestion would you like to see occur first? How do you overcome the negative arguments suggested?

2). Which of the suggestions is most likely to occur? Explain.

3). Overall, which suggestions do you feel have more plus factors than minus factors? Vice Versa?

Title: IF I COULD LIVE ANY PLACE ON EARTH!

Introduction:

Many people use open space as an argument against those who suggest that the world is overpopulated. There are many factors in addition to open space that must be considered when asking how many people the earth can hold. This activity explores population distribution by first having students locate what they consider to be the ideal place to live. After examining responses, students can identify those places on the globe where people congregate due to necessity or desirability. These factors of distribution must be considered when deciding how many people the earth can hold.

Objectives:

To identify and locate the one place in the world where students would like to live and to write down three to five reasons for selecting such a place.

To share students' choices with the class.

To use group processes to compile a list of the 10 most common reasons for choosing the ideal place to live.

To consider how much of the world's land meets the criteria generated by the class and discuss the implications of such findings for the question, "How many people can live on this earth?"

Grade Level: 7 - 12

Time: Two class periods

Materials: Have a number of atlases available for student use.

Procedure:

1. Ask students if they think there is room for more people on the earth. Have students explain their responses.

2. Hand out the blank map of the world and ask students to locate the place on earth where they would want to live if they could live anywhere they choose. Have atlases available so that students can look at different countries. You may also want to give students the evening to do this activity so that they can talk with friends and parents about their choice. After students locate a place, be sure they write down three to five reasons for selecting that location.

3. If possible, locate each student's choice on a map large enough for every student to see. An overhead projector and a transparency would work quite well.

4. Have students get together in pairs to combine their lists of reasons. Then have the pairs group as fours and combine their reasons. Then have students form groups of 8 and have them arrive at the 10 most common reasons given for choosing the ideal spot to live on earth. List these on the board.

5. Have the students look at the list and the compiled map. Do people in the class tend to want to live in similar locations? In what ways are the places similar?

   Would people choose to live in deserts? Would most people choose to live in very cold regions? Would most people choose to live far from or close to water?

6. Have students consider their answers to these questions. Then ask them to think again about the question you asked at the beginning of the class, "Is there room for more people on the earth?" Do any of the factors discussed in class affect their answers and thoughts about the question now? Can we say there is room for people on the earth just because there is open space? Can people live anywhere? Do people want to live anywhere?

Supplemental Projects

Title: Food Ideas

Introduction: Many activities are intended to be used with 20-30 students in a large group situation. This activity uses an individualized format. Participants are provided with a number of ideas for exploring issues and topics involving food. Participants may use these ideas in many ways. Some of the uses are discussed in the activity.

Objectives:

1. To provide participants with many ideas for participant study of food issues.

2. To provide participants with many choices from which each participant will make a choice.

Mechanics:

Time: Depends on each participant

Materials: Duplicate copies of the food ideas for student reference.

Activity:

There are a number of ways to use the food ideas.

1. Hand out the list of ideas and have the participants decide which activity should be done first by the group. The participants will have to share their individual criterion and ideas as to what is important to know about food. The ideas could be categorized in a number of other ways:
   a. Which are easiest to do?
   b. Which take the most time?
   c. Which ideas provide the participants with lots of facts? Opinions? New ideas?

2. The ideas could be written on cards and handed out to the group encouraging the participants to complete as many of the actions as possible.

3. One idea could be given to the entire group to complete at the same time.

4. The group could read over the duplicated list of ideas and then generate new food ideas. These could be compiled and added to the list.

5. The ideas could be displayed on a bulletin board. Then new food ideas could be added. As participants finished a task they could initial the bulletin board or put things they had done on the bulletin board next to that particular food idea.

FOOD IDEAS

1. Describe in writing a starving person, an overfed person. (What he looks like, how he feels, what he or she does.) Do this for a child and an adult.

2. Compile a list of the largest food manufactures (General Foods, General Mills, Beatrice Foods, etc.) and the products they sell. Find out what percent of items on the shelves in your supermarket come from these large corporations. (The business section of a good library is the place to begin for this research. Trade journals such as Food Engineering, Meat Processing, and even Advertising Age are also useful. Write for corporate reports.

3. Make a listing of some of your favorite meals. Are they well balanced? Prove it. Rank order these from those you would give up first to those you would give up last.

4. Make a report on the starving nations of the world. Where are they? Why are they short of food? What can and/or should be done?

5. You are a reporter at the world food conference in Rome. Write three articles for a newspaper covering the important issues and nations attending.

6. Compare the cost of a "convenience" food with the price of its individual components if bought separately -- for example, a tuna and noodle casserole. Determine how much time, if any, the pre-packaged item saves.

7. Plan the meals for your family for one day. (or one week) Make a list of the items you would need for these meals. When you are at the grocery store find the cost of each item. Find the total cost for the day's meal. NOW plan meals for a week on a welfare-poverty diet of $1 per day per person. What exactly can you buy with that money and are the things they plan to eat each day nutritious?

8. What is organic food? What is health food? Are either of these better for you? Why are they better for you?

9. Find out what are the 10 most commonly eaten foods around the world. This would be the basic foods such as wheat, beef, corn, etc. and not meals such as spaghetti.

10. How does the body break down food into different parts? For example: protein, carbohydrates, and fats.

11. Presentation on cultural foods and drinks around the world. How are they similar and how are they different?

12. Food taboos. Do we have any? What are some of the taboos around the world?

13. How does climate effect what kinds of food can be grown there? Make a list or draw a map showing the major foods of each climate.

14. Map or diagram the complete path of a food from its original source to the dinner table. What happens at each stage?

15. What has been the effect of insecticides and fertilizers on the food industry and the consumer?

16. Interview people in the Denver area who work with food or food products. Ask them to explain why the prices of food are rising so rapidly. Do they think we should help the poor countries with their food problems?

17. Do a food collage that has a message or theme to it.

18. Test advertising claims made for items sold in supermarkets. Compare the picture on the package or label with the real thing inside.

19. Write a report about different farming methods around the food.

20. Do a project that will raise money for food distribution to the poor in America or in other parts of the world.

21. Do a report on the hungry in America. In what ways are they similar or different from the hungry in the rest of the world.

22. Make a scrape book of articles you can find in the newspapers and magazines related to food or population. Classify the articles into different groups.

23. What will food be like in the future? Read some science fiction books or stories to get some ideas. Talk to some people in the food business.

24. Make a chart of the jobs or occupations there are that have something to do with food at any stage. Have your chart discuss salaries, job activities, and whether there are openings in the field as well as any other item you would like to chart.

25. What are the diseases caused by the lack of food? Describe what happens to the human body.

26. Investigate several diets that people use to lose or gain weight. (This may include one of the many kinds of "starvation" diets.) Figure out how many calories are consumed with these diets. Are these diets nutritionally adequate?

27. Describe something to eat. You must use all of your senses. Do not give the name of the food being consumed.

28. Find out the purpose of the following government agencies in regulating food: Food and Drug Administration, Food and Agriculture Organization, Federal Trade Commission, and Health, Education and Welfare.

29. Interview some of the grocery store shoppers you know to find out which items have greatly increased in price over the past year. Find out how much the item costs now and how much it cost before the price increases.

30. How does the body break down food into different parts? For example: protein, carbohydrates, and fats?

31. Write a report on UNICEF. What does it have to do with food?

32. Write a cow's view of a slaughter house. Write it in the first person.

33. National foods and drinks around the world. List them.

34. Write the complete history of a food from the earliest times up to the present.

35. Do a report on the various kinds of instant foods such as dehydrated, freeze-dried, etc.

36. How does food spoil?

Title: Rich Nations/Poor Nations (by Richard Schweissing)

Introduction: It is extremely difficult for people of an affluent nation to either generate empathy for the dilemma of hunger faced by most of the world's people or to identify with the feelings of animosity persons in poor and hungry lands have for the affluent nations. An activity that generates these feelings within a group of people will go a long way toward developing the kind of attitudes necessary to motivate people to search for solutions that will alleviate the world hunger problem. This activity is designed to create a simulated confrontation between the "haves" and the "have nots."

The concept of conflict/conflict resolution is most directly the target of this exercise as the group is divided between rich and poor, and various means are applied--or ignored--to create equity.

This activity is conducted in conjunction with other appropriate activities of the leader's choice. The group is randomly assigned as rich or poor at the beginning of the session without knowing their role. They then pursue the other activities planned by the leader while two kettles of food are heating on hot plates at the back of the room. Following the activities the group is fed. A small number who comprise the "rich" group receive large portions of a tasty meal while the bulk of the group, those randomly assignated "poor," receive limited portions of a rather tasteless meal.

The leader needs to select another activity for the group to do while the food is cooking. It could well be another appropriate activity from this packet. Ideally, it would be an activity focusing on food shortages in the world.

Lesson Objectives:
As a result of completing this activity, individuals should be able to:
1. Describe the feeling created by having little in the presence of abundance or vice versa.
2. Suggest potential responses by poor nations toward the affluent nations.
3. Articulate policies that would lead to better relationships between rich and poor nations.

Mechanics:
Teaching time: One hour, in addition to other planned activities
Materials: Cards containing random numbers. No more than one card with a number below 10 for each 15 people. Plates and spoons for everyone. Food as described in the activity in sufficient amounts along with two kettles and 2 hot plates.

Activity:
1. This activity will be most effective if it is scheduled at a customary mealtime, when participants will experience the effects more significantly.

2. Before the group arrives, prepare two kettles of food which preferably will need later only to be heated. One kettle should be CSM (see included recipe) in a quantity sufficient for about one cup per person in the "poor" group. The other kettle should contain a stew or casserole that is virtually a complete meal and will give off a tantalizing aroma while it is heating. The food should be heating throughout the session, but the group should not be permitted to investigate, which may be easier if the kettles are not turned on until the group is in and seated.

3. As the group arrives, ask each person to draw a card. Explain that this card is their meal ticket and they will not be served if they don't have it.

4. Proceed with the other activity, which should take about an hour.

5. By the time the activity is over, the aroma from the food should have everyone hungry. Ask them to line up so they can pick up a plate and utensils before passing the kettles, with their meal tickets ready since they determine

which menu is served. As they submit their meal tickets, those with a number of 10 or more will be served a cup of CSM. Those with a number less than 10 will be served from the pot of tasty food.

6. While people are eating, the leader should carefully observe the activity and discussion. When people have had ample time to eat (and the rich may even be allowed second portions) a debriefing of the experience should take place.

7. Debriefing: This section is largely contingent upon what happens during the meal. Did the rich share? How did the poor treat the rich?

Some suggestions to use as springboards for discussion are listed below. However, a sensitive leader will move from them to other areas raised by the group. Also, the leader may want to ask specific individuals to explain comments or actions they took that are not anticipated in the following questions:

a. To the poor--How did you feel when you saw what you had for a meal? How did feelings compare between those served before any of the rich and those served after the rich?
b. Once it became apparent the menus were radically different, how did those not yet served feel as they approached the server?
c. How did the rich feel when they discovered which group they were in?
d. How did the rich feel once they began eating in the midst of the poor? Or if they sat apart, why?
e. Why did the rich choose to share--or not share?
f. How did individuals of each group feel toward the others?

Ultimately, the leader must keep in mind his ultimate goals for the session, and, while individual groups will wander from the above questions to deal with their own unique experiences, the group should eventually be pulled back to the following:

a. What was realistic about the experience? What was unrealistic?
b. Was there a better way to deal with the problem?
c. How are our actions comparable to policies between nations?
d. How could these policies be improved?

A Suggestion----------Why not substitute CSM for the regular lunch at your school or business and send the saved $ to the world's hungry through an organization of your choice. One such organization is UNICEF, 331 E. 38th St., New York, NY 10016.

CSM

(BLENDED FOOD PRODUCT, FORMULA NO. 2):

WHAT IT IS:

CSM is a mixture of 64% processed (precooked) cornmeal, 24% toasted defatted soy flour, 5% nonfat dry milk, with added oil, vitamins and minerals. It is a highly nutritious supplementary food, particularly for infants and children in a low protein status. The calorie value of CSM is about 1698 calories per pound. It contains 20% protein and the Protein Efficiency Ratio (PER) is 2.48, compared with 2.50 for casein. CSM is almost completely precooked. It is bran-free, bland in flavor, and smooth in texture.

WHAT IT DOES:

CSM may be used to prepare simple soups and gruels, or porridges. CSM may be baked, fried or steamed. When mixed with water, CSM forms a smooth dough. CSM can also be prepared as a dessert or beverage.

GENERAL INSTRUCTIONS:

Always mix CSM with *cold* water. It is best to first place the water (with salt to taste) in a bowl, and then slowly add the CSM while stirring. Cooking time for soups and gruels will be from 2 to 8 minutes at sea level, depending upon the size of the cooking utensil and the heat of the fire. ***Always continue stirring while CSM is boiling.*** Cook until smooth. Consistency may be varied by increasing or decreasing amount of water used.

RECIPES:

SOUP

1 cup CSM
6 cups *cold* water
salt to taste
seasonings, vegetables, meat, stock

Place water in a bowl. Slowly add the CSM, stirring. Heat mixture to a boil, stirring constantly. Add other ingredients as available, to taste. Cook until smooth, from 2 to 8 minutes. If soup is too thick, add more water.

BEVERAGE

Follow instructions given for soup, but use 8 or 9 cups of cold water, depending on consistency desired. Add sugar and flavoring to taste. Serve hot or cold.

GRUEL OR PORRIDGE

1 cup CSM
4 cups *cold* water
salt, sugar to taste

Place water in a bowl. Slowly add the CSM, stirring constantly. Add other ingredients, heat to a boil, *stirring constantly*. If gruel is too thick, add more water. When mixture is smooth, remove from fire, and serve.

PUDDING

1 cup CSM
4 cups *cold* water
1 cup sugar
few drops vanilla or spices

Place water in a bowl. Add CSM slowly, stirring constantly. Place on fire. When mixture starts to boil, add sugar. *Continue stirring until boiling starts again,* cook until smooth, then remove from fire. Add vanilla or other flavoring. Serve hot or cold.

BASIC DOUGH INGREDIENTS

1 and 1/3 cups CSM
2/3 cup wheat flour
½ cup lukewarm water
½ ounce yeast + 1 tsp. sugar + ¼ cup lukewarm water

Title: Insects: Fried or Broiled (by Nancy Miani)

Introduction: How many things, plant or animal, could we eat that we don't eat now? In this activity participants read about insects as food sources and then receive encouragement to try a couple of activities which could expand our ideas about what is edible, although the activity experiences probably will not change actual eating habits. To do that we would need to examine many other factors as they affect our values culture, and life style.

Lesson Objectives:

1. To demonstrate to participants that what we eat is determined by many factors.
2. To demonstrate that many other items are edible that we may not have considered edible.
3. To try out a food that is new to the participants and to record and discuss the reactions.

Mechanics:

Time: 1 class period

Materials: You will need to duplicate the student handout titled "Food for Thought" so that each student has one.

Activity:

1. Hand out the reading to the class. After they have read the article ask them to explain why they would or would not eat an insect. Do not judge the responses. Ask students to try to identify something they eat that other people might not want to eat or might see as strange. Have the students list other plants or animals that they don't eat that might be good to eat either in taste or nutritional value. Have students check out these foods to see if they are edible.

2. Have the participants do either or both activity 1 or 2 listed on the student handout. Share and discuss the results after students have completed the activities.

3. Color advertisements to go along.

Food for Thought

Food prices bugging you? Why not eat insects? A growing body of scientific evidence suggests there is no good reason for humans not to eat insects.

For example:

What has more protein than fish, less fat than prime beef, about 160 calories per ounce, can be grown rapidly in great quantity, and is already eaten and enjoyed by thousands of people around the globe?

Termites, of course. Not to mention multitudes of other insects.

In the face of world food shortages, some scientists recommend raising insects on a large scale for human consumption.

The idea isn't new. Entomophagy (insect-eating) has been practiced in nearly every corner of the world at some time in history. Ancient Greeks rated grasshoppers a great delicacy (our Great Plains abound in grasshoppers). Roman epicures fed beetle grubs on meal to fatten them and heighten their flavor. The Bible contains references to insects as food. St. John the Baptist survived in the desert on locusts and wild honey. Moses described four kinds of insects the Hebrews could eat.

In Japan, silkworm larvae are a traditional favorite.

In Southeast Asia, a British entomologist listed spiders, dung beetles, water bugs, crickets, termites and cicadas among insects consumed.

Dr. Dean F. Gamble of the National Agricultural Library believes up to 10 tons of insects a day could be produced in a single operation utilizing waste products such as manure.

Vincent M. Holt, a 19th century author, wrote, "There are insects and insects. My insects are all vegetable feeders, clean, palatable, wholesome, and decidedly more particular in their feeding than ourselves. While I am confident that they will never condescend to eat us, I am equally confident that, on finding out how good they are, we shall some day right gladly cook and eat them."

The subject of insects for dining isn't too palatable. But it is food for thought.

<u>The Denver Post</u>, July 7, 1975.

An editorial such as this one points out how strongly values influence our lives.

Some activities:

(1) Serve commonly available foods which have never been served in your home before. In some homes, tropical fruits such as papayas, mangoes, pomegranates, guavas, etc. may be new. Record your family's reactions.

(2) It is the year 2014. Write an ad for a snack product introducing a new, high protein food source for the first time -- insects. The ad will appear in a food-oriented consumer magazine like FAMILY CIRCLE. It is your task as the ad writer to make the new product appealing and highly marketable.

Title: Holiday On Food - Mary Lou Mohler

INTRODUCTION:

Holiday celebrations play an important role in the lives of many people. In many instances, these celebrations involve traditional dinners or foods. This activity is designed to make students aware of the relationship between tradition and culture and food.

OBJECTIVES:

1. Students should be aware of the part culture and tradition plays in food choices.

2. Students should be able to identify various culture's holidays and list typical foods connected with them.

MECHANICS:

One class period for research.
One period for making posters.

MATERIALS:

Poster board, glue, scissors, magazines, magic markers and books about.

ACTIVITY:

1. Students working in small groups research holiday customs throughout the world. They can make lists of foods associated with them. Next, they can begin planning a poster to depict their findings. Students can find pictures in magazines or in cases of more unfamiliar foods write descriptions.

2. Posters can be placed around the room and used as a basis for discussion.

Title: POP QUOTES (MOBILES IN THE CLASSROOM)*

Introduction: Quotes can stimulate us to think about a topic. Quotes can interest us in a subject that is not at first of interest, especially if the quote is funny. One way to spark students to think about population-related issues is by making mobiles of quotes about population and then using the quotes in any of the ways described in this activity. Kids can make the mobiles, they add color to the class, and they serve as constant reminders during the unit of some of the important concepts and issues with which the students will be dealing. Believe it or not, the mobiles can also be used as the evaluation instrument for a unit on population! Read on to find out more about the use of pop quotes in the classroom.

Objectives:

To spark student interest in a variety of population issues by presenting them with short quotes that are funny and interesting.

To use quotes as a stimulus for discussion of some of the important population and food issues.

Time: One class period to make mobiles; one class period to discuss.

Materials: Poster board (different colors), scissors, colored markers or paint, duplicated list of quotes, string to hang the mobiles

Procedure:

1. You can make the mobiles yourself and hang them up, or you can make them as a class activity.

2. Hand out the quotes. Let pairs of students make mobiles out of the quotes. Have them vary the sizes and shapes of the mobiles. Also, have them write their quotes on both sides of the mobiles. Then, hang the mobiles.

The following are a number of ways the mobiles can be used once they have been displayed.

1. You can leave the mobiles up and discuss different ones throughout the unit as students ask about them. Usually, one student will ask a question about a mobile and that will lead other students to ask questions about the meaning of other mobiles.

2. You can have students pick two or three mobiles for which they will write explanations. Students should be given time (one week or two) to write these explanations. Most of them will be explained or dealt with as you do other population and food exercises during your class' study of population. Students may also do some research on these items. Then, students report their conclusions to the class.

*Developed by George G. Otero Jr. Quotes collected at NSF Summer Institute, Cincinnati, Ohio, 1973.

QUOTES FOR MOBILES

1. ZPG is like hitch-hiking--you know you'll get there, the only question is when and how.
2. 1 + 1 ≠ 2 in many families.
3. What makes you different from anybody else? It's probably the genes you're wearing.
4. Support ZPG--go bowling.
5. Replacement level ≠ ZPG.
6. Spaceship earth --a finite system.
7. Population Explosion = Fact
   Population Crisis = Opinion
8. What is optimum population?
9. Quality vs quantity--a crucial concern.
10. Save water--shower with a friend.
11. Calhoun's rats were dense!
12. "To be" has become to mean in the developed countries "to have." (Goulet)
13. Will the stork pass the plow?
14. Will the baby boom boom?
15. There are so many people in the world, that God cannot appear to them except in the form of food. (Gandhi)
16. Growth for growth's sake is the philosophy of the cancer cell.
17. Help ecology: Take a lemming to the beach.

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Explanation of Quotes

1. Population cannot grow forever, there are limits. The question is how we will reach those limits: by choice and planning or as a result of natural biological controls such as those mentioned by Malthus? Maybe both?
2. This rests on the fact that simple addition doesn't work in social situations such as families. A woman and a man joining in marriage almost always results in a group of 3 or 4 and NOT 2.
3. Simply a play on the word genes.
4. Going bowling is not the way to support zero population growth. This points out a myth about how we attain ZPG. Abstention is not the approach. Family planning and adequate availability of birth control approaches is probably better.
5. The replacement level is often said to be the same as ZPG. This is not true. With ZPG the total number of people in the population will stay the same from year to year. A nation that has reached the replacement level (1 child for each adult) can still grow in total population because of the distribution of the population by age (people live longer!).
6. The earth is limited in the space, food, water, and shelter it can offer its inhabitants. Although we may not know the exact limits, we must be aware that there are limits and the population cannot grow forever.
7. By most definitions the world population is exploding. Exponential growth operates that way. That is a fact. Yet it is opinion when we consider this growth as a crisis or not. Some countries do, some don't. Some people feel this growth can be controlled and some people believe that growth is already uncontrollable. What do the students think?
8. This quote simply introduces the term "optimum." What is the best or ideal or most people this earth can hold? Under what criteria will you make a judgment?
9. To some people the population issue is stated in this quote. Do we want more people and things or do we want better quality in the people and things we already have around? This is a crucial question.
10. This is again a humorous quote with no large message, but you or your students may find one.
11 Calhoun is a scientist who experimented with crowding and rats. You can locate this experiment in the Reader's Guide under Calhoun's name. These rats became extinct most of the time in the experiments. Not only were they densely crowded but they were dense in letting their group become extinct!
12. Get it.
13. The stork represents births and the plow food production. Will it or has it already?
14. The baby boom is the period in US history after WWII up to 1957 where birth rates were very, very high. If all these babies have lots of babies the population will explode because of exponential growth.

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15. Good statement from Gandhi about other perspectives on the problem for many people in the world. Also indicates what religion must do.
16. Many people think growth is good anytime and always. By comparing that philosophy with the pattern of cancer helps raise questions about this philosophy.
17. Lemmings are small animals that control their population by periodically throwing themselves in the ocean. Look up the story. What other methods of control are there?

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Title: Meet the Press by Debbie Stein (This activity is modeled after the Meet the Press activity developed by educational development corporation for people and technology.

INTRODUCTION:

Students will be involved in a press conference as representatives of various magazines and newspapers as officials and workers of first, second and third world countries.

OBJECTIVES:

1. Students will be able to list at least two points of view held by people in different societies.

2. Students will collect and be able to use data for the purpose of representing a decision.

3. Students will be able to formulate a question.

ACTIVITY:

1. Students are assigned roles. One student should be assigned to be the moderator.

2. Time - (1 to 2 days) should be allowed for students to develop information for their role. Current news magazines and almanacs are suggested references. Students who represent magazine and newspapers should look at several issues of that particular reference and find the following things:

   a. Are there any articles on food and population? If so, who wrote them? How do they feel? Do they take a particular stand?

   b. If the paper or magazine contains an editorial section, students should look at this also (the teacher may need to help students pick out the paper's position, a week's chart of items in the newspaper may help students develop an overall picture.

   c. Look for interviews conducted by a staff member. Note the kinds of questions that are asked. (U.S. News and World Report publishes both questions and answers)

Students who represent the country should:

   a. Gather information about the size, population, products and climate for the given country.

   b. The size of the country, does it have too many people, too little food, or possibly the means to get more.

If available, read about people in the particular country. Junior Scholastic frequently interviews people from foreign countries.

Write a short statement about the feelings and attitudes about food and population issues.

3. Set up the room so that editors are on one side facing the interviewees.

4. Establish a speaking order and review the speaking rules.

5. After the press conference, ask the editors to write up a story of the conference. Students representing countries should write an account of their feelings on being questioned by the American press.

Title: Producing the Filmstrip by Debbie Stein

INTRODUCTION:

Making a filmstrip is not only fun activity for students, but allows students to use a different medium to express their ideas.

OBJECTIVES:

1. Students will collect, organize and edit information.
2. Students will draw and verbalize the information collected and their feelings about issues of food and population.

MATERIALS NEEDED:

1. U--film ($5.00 per 25 feet. Enough for at least 15 frames per student or 20 for a group) Old filmstrip may be used which has dipped in bleach to remove the pictures already on them.
2. Grease pencils.
3. Strips of plain white paper approximately one-inch wide.

ACTIVITY:

1. Students may be divided into small groups of work or work individually depending on the time and materials available.
2. Students should be instructed to choose one of the following ideas as the subject for a filmstrip.
   a. Food problems in any given area of the world.
   b. What do people eat?
   c. Population problems in any area of the world.
   d. New ideas for growing food.
   e. Any other related to the subject.
3. When they have chosen a subject, they may begin to gather information. Librarians may be helpful in collecting appropriate materials.
4. When they feel they have enough information, they are to plan their pictures on the strip of white paper.
5. U--film may be drawn on (nail polish removes mistakes, film may be typed on, or written on in ink). After they have drawn out the film strip on paper, they may reproduce it on the U--film.
6. A paper written script should be developed to go with the filmstrip.
7. Students then present their work to the class.

A series of five starter activities on energy.

Title: ENERGY QUICKIES

Introduction: This series of activities is designed to stimulate interest in the field of energy.

Objective:

To spur interest in energy.

Grade Level: 6-12

Time: Varies with activity

Materials: None

Procedure:

Step 1. Write the following five activity suggestions on the chalkboard. Groups or individual students can choose one or more of the following activities to do and report their findings back to the class.

Suggestion 1: You'll need a camera and film for this activity. Any camera will do, but a polaroid is preferable because of the fast development time. Take a series of pictures of energy. Any definition will do.

Suggestion 2: Count the number of electric lights in your house. Then, count the number of houses in your block. Multiply the number of houses times the number of lights in your house. Using a city map, calculate the number of blocks in your city, then multiply that number times the number of lights in your block. How many lights do you find? Find out how much energy would be saved (in Kilowatt hours) if your city eliminated 50% of its electric lights.

Suggestion 3: Write a script for and act out a one-act play titled "The Year the Lights Went Out."

Suggestion 4: You'll need a portable cassette tape recorder for this one. Record as many different sounds as you can find that energy makes.

Suggestion 5: List at least one nonelectrical energy consuming alternative for each of the following items:

Television	_____	Telephone	_____
Stereo	_____	Clothes Dryer	_____
Dishwasher	_____	Light Bulb	_____

Gary R. Smith

SP20

Title: POSTER CONTEST

Introduction: After students have learned about energy and the need to conserve it, they may be eager to express their ideas to others. This activity will give students a chance to express the ideas they have formed about energy conservation. This could be carried out by an energy-conservation campaign in your school or in your community.

Objectives:

To express ideas about energy conservation.

To make posters showing ways in which energy can be conserved and used wisely.

Basic Skills: A. Data interpretation

B. Picturing and communicating ideas

Grade Level: K-6

Time: 20 minutes for directions plus time for making the posters either in or out of school

Materials: Poster paper and art supplies
Handout, "Energy-Saving Tips"

Procedure:

Step 1. Briefly discuss what the class has studied about energy conservation. You may also want to discuss some of the energy-saving tips on the handout.

Step 2. Ask the students if they would like to make some posters that advertise the need to conserve energy. (It might be possible to get some support for a contest from a community organization, such as Kiwanis, Lions Club, or the school PTA or Student Council. Perhaps the organization could provide some prizes.)

Barbara A. Smith

Step 3. Set up rules for the posters:

A. Size (minimum and maximum)

B. Medium (paints, chalk, crayons, etc.)

C. Deadline for turning them in

D. Criteria to be used in judging (originality, neatness, quality of ideas advocated, etc.)

Step 4. Secure the services of several people to be judges.

Step 5. Find a place to display the posters for judging and exhibit.

Step 6. Decide upon a good place to hang the posters after the contest.

ENERGY-SAVING TIPS

HEATING

-- Good insulation, and in particular adequate attic insulation, is the key to reducing the energy you consume for heating. Public Service Company recommends insulating your attic to an "R-30" standard. Insulation for outer walls and floors is also important. (Insulation is also the best way to conserve energy used in air conditioning.)

Additional fuel saving steps you can take include installing storm doors and either storm windows or thermalpane glass in your windows, weather-stripping doors and windows, and caulking around windows. (Always make sure, however, that there is adequate ventilation in your home to prevent carbon monoxide and other combustion by-products from your furnace from building up inside the house.)

Choose the lowest comfortable setting for your thermostat, and don't turn it above that. Also, turning down the thermostat a few degrees overnight while you are sleeping will save fuel.

If you leave home for a few days, set the thermostat five or ten degrees lower than your normal setting.

If you have a fireplace, close the damper when it is not in use. An open damper can allow very large amounts of heat loss from your home.

Remember that warm air rises. By making sure all openings to your attic are well sealed you can prevent the escape of heat into nonliving areas.

Close the drapes over your windows at night or when it is cold outside. Heat escapes quickly through glass, and this will provide an extra layer of insulation.

Clean or change air filters in your furnace periodically so that the free flow of warm air will not be retarded. Also try to arrange furniture and drapes so that they will not interfere with the flow of heat.

Avoid excessive opening and closing of doors during the winter. Exhaust fans in bathrooms and kitchens also result in heat loss, so use them with discretion.

Have your home heating system maintained regularly by an expert.

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LIGHTING

Fluorescent lights produce more light for the same amount of energy and last longer than incandescent bulbs. In fact, they are two to three times more efficient, and last from seven to 10 times longer than incandescent bulbs.

The efficiency of incandescent bulbs increases as the wattage increases. That means, for example, that you get more light from one 100-watt bulb than from two 50-watt bulbs, even though they use the same amount of energy.

Simply cleaning bulbs and fixtures regularly will help you get at least 20% more light.

Use low wattage bulbs for decorative purposes, and higher wattages for such tasks as reading, sewing, and other sorts of close work.

And, of course, always turn lights off when they are not in use.

APPLIANCES

As a general rule, small appliances use less energy than large ones. Therefore, using a small appliance in place of a large one whenever possible conserves energy.

Do not pre-heat appliances such as stoves, frypans, irons and the like any longer than necessary; those are big energy users.

Use appliances such as washing machines, dryers and dishwashers when they have a full load. These appliances use the same amount of energy each time they are used, and doing many small loads instead of a few big ones wastes energy--and your money!

Another source of wasted energy can be easily controlled by simply taking care to turn off radios, televisions, stereos or any other kind of appliance when not being used.

Always keep filters and vents on any kind of appliance clean.

Maintain your appliances in good repair. Worn parts not only can increase energy use needlessly, they can cause excessive wear on other parts, resulting in even more costly repairs.

Don't overload electrical circuits. This results in reduced energy efficiency and also can create a safety hazard.

Read the "use and care" booklet that accompanies each appliance. Improper use of appliances can waste energy and damage them, too.

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When selecting temperatures or cycles with appliances like washers, dryers and dishwashers, don't select settings that are warmer or longer than necessary to do the job at hand.

A leak of one drip per second in a hot water tap will pour 2,500 gallons of hot water down the drain over a one year period. You pay not only for the water, but the fuel it takes to heat it.

Showers use less energy for water heating than baths, as a rule.

Keeping your refrigerator and freezer defrosted makes them more efficient, and they will use less energy.

Keeping your refrigerator's condensor clean will make it run less frequently, keep foods properly chilled and prevent the possible burning out of the condensor.

When cooking, learn to depend on timers and thermostats instead of opening the oven door or lifting lids on pots. This only wastes heat and energy, and slows down the cooking process.

Try to plan oven meals with foods that can all be cooked at the same time. This can save a considerable amount of energy.

There are actually countless ways to save energy in the home that your own common sense will suggest. If you get into the habit of looking for ways to save energy, you will be holding down your gas and electric bill at the same time.

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Title: INVENT A TOOL

Introduction: This activity requires students to manipulate. Using ordinary "classroom junk," students create their own tools--tools that use no (non-renewable) energy. Students complete the activity by developing an advertisement for their "tool." Ads will comprise a class *Tool Catalog*.

Objectives:

To manipulate materials to create a tool.

To articulate about alternative sources of energy.

To compare and contrast their new tools with tools and inventions of the past.

To articulate about the absence of energy (non-renewable forms).

To articulate about the tool-making process.

Grade Level: 5-12

Time: 2 Class periods

Materials: See list provided on "Invent a Tool" handout

Procedure:

Step 1. The teams of toolmakers may have to gather some special materials of their own, but for most purposes the following materials should be sufficient. Gather in advance:

wire	clothespins	flat sticks and dowels
pulleys	straight pins	paper tubes (mailing tubes)
string	mirrors	roll of brown paper
straws	paper clips	elastic bands
glue	tin cans (#10)	tongue depressors or popsicle sticks
tacks	small mirrors	
magnets	safety pins	sheets of cardboard
scissors	masking tape	

Jacqueline Johnson

Students can be asked to bring in some of these things or other "junk" that might be useful. You may want to ditto and hand out the list titled, "Invent a Tool," which is provided at the end of the activity.
You may want to take pictures of this activity showing different tools in the making and/or being demonstrated.

Step 2. Describe the task. Tell the students the following:

They are going to invent and make a tool that uses no non-renewable energy.
They may work individually or in teams.
The tools are to be simple but *real*--they should work.

The ideas for the tools can be their own or chosen from the list provided.

The completed tools are to be demonstrated to the class.

Tools have to be made in one or, at the most, two periods. (Decide how much time you want to spend.)

Mention that there are two basic approaches: start with an idea of something that needs to be done and design a tool to meet the need; or look at the materials at hand and ask yourself, "What useful tools could we make with these materials?" Ask students to note which approach they are using.

Step 3. Group students according to their own preferences into teams of 2. While the tools are being made, circulate among the groups. Give assistance as needed. Take some pictures. Help the teams find materials.

Step 4. Tool demonstrations. These should be relatively short, a few minutes each. Arrange the room so that everyone can see what is going on. Some explanation will go along with each demonstration, but the emphasis should be on demonstrating the tool's uses.

Step 5. Tryouts. After the demonstrations, take a break to allow others to try out the tools.

Step 6. Discussion. What did students observe about:

The energy needed to operate their tools?
The new tools as a whole?
Any particular tool?
The usefulness of tools?
Things that happened to them while making their tools?

Follow-up:

If there is substantial interest in this activity, individuals might put together a "catalog page" with pictures and descriptions of their tools (Purpose, materials, energy needed to operate, cost, etc.) in the style of the *Sears Catalog*.

Also a fun follow-up: Find an old *Sears Catalog*.(Often among garage sale treasures, second-hand book stores and who knows where else?) Compare the "new" inventions with the old ones. Fun comparisons with energy use can be found.

INVENT A TOOL

Make a tool that solves a problem you have thought up.

Make something that will allow you to pick up a paperclip from the floor without bending over.

Make something that allows your voice to be heard at a great distance.

Make something with which you can see over a high fence.

Make something that makes music.

Make something with which you can inflate a paper bag without using your lungs.

Make a tool for picking up one sheet of paper at a time.

Make a tool that can be used to produce a work of art.

Make a tool that allows you to lift a penny out of a cup of water without getting your fingers wet.

Make a device that measures the distance you go while you walk.

Make a tool for picking up a grain of salt.

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Title: SOLAR HOT DOGS

Introduction: Depending upon where you live, this gadget will cook a hot dog in a few minutes to half an hour. You merely point the reflector at the sun so its rays are focused upon the hot dog. You need not be a craftsman to build it. Take these plans to your local hardware store and ask a friendly clerk for help. Or maybe the school shop teacher would be willing to barter.

Objectives:

To articulate about alternative sources of energy.

To manipulate materials to create a "solar hot dog cooker."

To articulate about the building process.

To assess the importance of harnessing solar energy.

Grade Level: 7-12

Time: Variable
Eating time - 5 minutes

Materials: Handout, "Solar Hot Dog Cooker"
Handout, "Sunshine on His Eggs"
Advertisement
Hot dogs, buns, and condiments

Procedure:

Step 1. Build the cookers. See next page for instructions.

Step 2. Buy hot dogs, buns, mustard, catsup, pickles, onions, etc.

Step 3. Let the class cook and eat the hot dogs.

Step 4. Distribute advertisement from *Denver Post*. Have students create their own ads for their Hot Dog Cookers.

Follow-up:

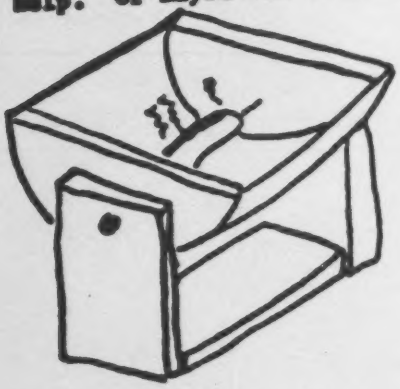
1. Distribute reading, "Sunshine on His Eggs."

Jacqueline Johnson. Ideas from Roberta Rosen and Barbara Dunn, Cherry Creek Public Schools; and Sunshine Company, University of Colorado at Denver.

2. Get additional ideas for projects from D.S. Halacy, *Solar Science Projects For a Cleaner Environment*, Scholastic Book Services, 1974.

SOLAR HOT DOG COOKER

Depending upon where you live, this gadget will cook a hot dog in a few minutes to half an hour. You merely point the reflector at the sun so its rays are focused upon the hot dog. You need not be a craftsman to build it. Take these plans to your local hardware store and ask a friendly clerk for help. Or maybe the school shop teacher would be willing to barter.



MATERIALS***

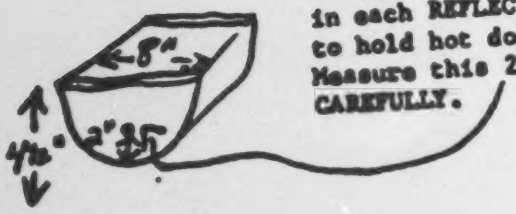
(1) BASE. 12½" long of 1"x8" wood.
(2) SIDE SUPPORTS. 8" long of 1" x 8" wood.
(2) NAILS to hold the dog. 4" long #60
(2) ROUND-HEAD WOOD SCREWS 1 3/4" long
(2) WASHERS for wood screws
(20 to 25) NAILS for reflector and base 1" long
(1) REFLECTOR Spectular finish aluminum 12" x 16"
(2) REFLECTOR SUPPORTS 4½" of 1" x 8" wood

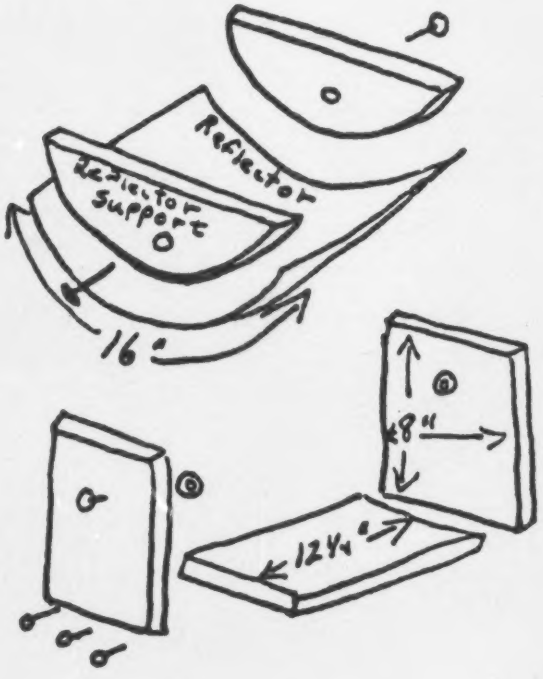
DIRECTIONS***

A critical but simple part of the cooker is the REFLECTOR. Aluminum works best, but you can get by with shiny aluminum foil glued to a piece of heavy but flexible cardboard. The REFLECTOR should be EXACTLY 12" wide.

*Center REFLECTOR on REFLECTOR SUPPORT and hammer first nail continue nailing along curve until REFLECTOR is secured. You will need three hands to do this.

*Drill 1/8" diameter hole in each REFLECTOR SUPPORT to hold hot dog nails. Measure this 2" distance CAREFULLY.





Adapted with permission of the Sunshine Company, University of Colorado at Denver.

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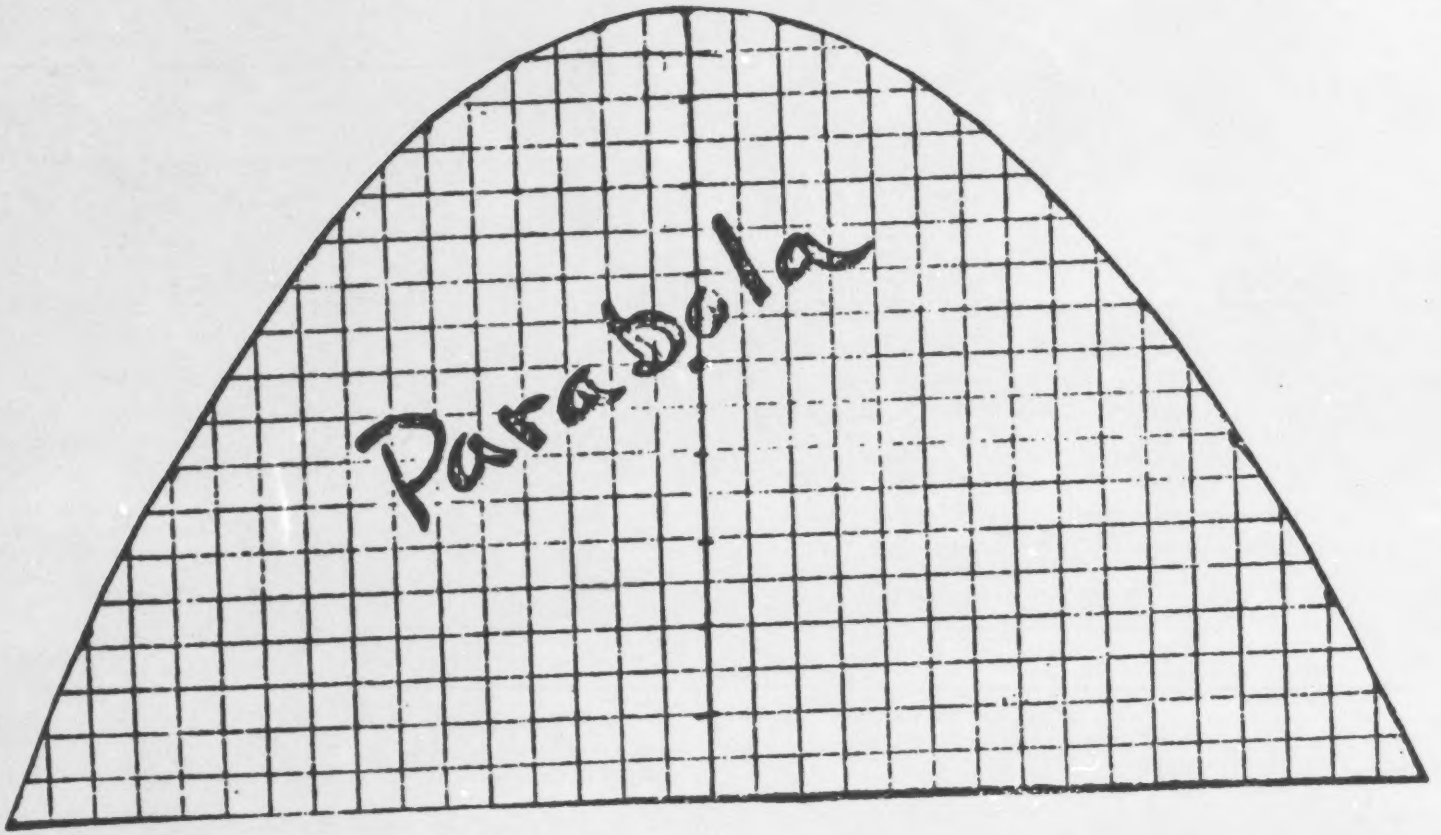
SOLAR HOT DOGS
Pattern for Hot Dog Cooker curve



SP33

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Sunshine on His Eggs

THE lucky old sun used to have nothing to do but roll around heaven all day. Now David Menz has put the sun to work frying eggs. David, 16, from West Hartford, Conn., has invented a sun-powered cooker.

To make his solar cooker, David used packing boxes, aluminum foil, and glue. The cooker focuses the sun's rays on pans holding food—and its temperature reaches a sizzling 430 degrees F.

David Menz, in his backyard, cooks an egg and a hot dog on his solar cooker.

Current Events recently spoke with David about his solar cooker:

"My grandfather didn't think my plan for a solar cooker would work. But he ate the first egg I cooked with my invention, and he said it was out of this world.

"I can cook almost anything with it—eggs, grilled cheese sandwiches, toast, hot dogs. Yesterday I cooked bacon for my family's Sunday breakfast.

"Building the cooker wasn't too complicated. But it was tough laying the sheets of foil to make a good reflecting surface. The foil tends to wrinkle. A mirror in perfect form would be more efficient.

"I think solar cookers will come into general use. They could be sold in kit form, using a cardboard frame and maybe parabolic curves* stamped out in plastic. However, solar cookers can only be used as backup cookers. They won't work, of course, on sunless days or at night.

"I've just started working on a solar distiller, or water purifier. The distiller will make salt water or polluted water drinkable. I think it should have a good future. Supermarkets around here are selling distilled water.

"I want to help homeowners cut down on expensive energy. At the same time, there is a lot of wasted energy in the world, with the sun and wind not fully used."

That was David Menz, future king of the solar cooking industry. Pass the eggs (sunny-side up).

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*What kind of curves? Time out for a look at the dictionary.

From *Current Events* (September 21, 1977).

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Here's an ad for solar energy from the Denver Post. Create your own ad for your Hot Dog Cooker. Give it a price too.

SOLAR ENERGY
AT A PRICE
YOU CAN AFFORD!
$4950.00
Use SUN-HEET'S add-on solar plan. Starting with a cost of $4,950.00 — for most homes — you NOW can cut your fuel bill. Then, as fuel prices go up, you can increase the number of SUN-HEET'S solar collectors at any time in the future and be energy independent. Oil shortages will be no headache to you. Solar heating is now more practical than ever before, and we are now beginning the exciting SOLAR-ENERGY AGE. INSTALL NOW. the price will never be lower!
• NEW & EXISTING HOMES
• COMMERCIAL USE
• AGRICULTURAL
• GREEN HOUSES
• SWIMMING POOLS, ETC.
PACKAGE INCLUDES:
• One 6'x10' SUN-HEET Solar Collector
• Full Capacity Storage Unit
• Heat Exchangers
• Pumping Units
• All Connecting Copper Piping
• Electrical Controls
ADD ON SOLAR COLLECTORS AS YOU DESIRE.
FREE SEMINARS
EVERY TUESDAY
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IN OUR OFFICE
OUR SOLAR COLLECTORS SUPPLY HEAT FOR:
FORCED DRAFT AND HOT WATER SYSTEMS: ALSO
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Teacher Information Only

No. 6 January, 1977

Religious Attitudes Toward Birth Control

Shift in Religious Doctrines

In every culture sex has a religious and ethical dimension. But today, contrary to conventional wisdom, religious attitudes are not a major barrier to birth control. First, religious doctrines themselves have changed dramatically; second, even where religious prohibitions remain, they have less effect on individual behavior than other factors such as the availability of family planning services or the role and education of women. In developed countries like the United States, for example, differences in contraceptive use between Catholics and Protestants have virtually disappeared. In developing countries like India, when income and education factors are taken into account, Moslems and Hindus accept family planning in almost equal proportions.

Public acceptance of family planning and the shift in religious doctrines have both been fairly recent. Most religious doctrines have traditionally encouraged procreation as the primary function of marriage. As late as 1920 nearly all religious bodies opposed birth control. Today, nearly all permit or endorse it, emphasizing the right and responsibility of parents to manage their own fertility. Even the Catholic hierarchy—now somewhat isolated in its opposition to contraceptives—no longer disputes the need for planned families, only the choice of methods.

Lingering Conservatism

Still, the importance of Catholic doctrine together with lingering prejudices against specific contraceptive methods in other religions cannot be discounted. At the national level governments, especially in Latin America, may delay needed expansions of family planning services for fear of reactions from conservative elements. At the international level, donors may limit their support for controversial services such as abortion or sterilization.

At the grass roots level, formal religious doctrines are often intertwined with rural folk beliefs and cultural patterns. Some of these, related, for example, to the inferior status of women, the preference for sons or superstitions about sexual potency and the menstrual cycle, can affect local attitudes toward either birth control in general

"The responsibility for deciding upon the number and frequency of children has been laid by God upon the consciences of parents everywhere . . . . The means of family planning are in large measure matters of clinical and aesthetic choice . . . . Christians have every right to use the gifts of science for proper ends."
Lambeth Conference, 1958, of Bishops of the Anglican Communion

or specific methods. In Moslem, Hindu and Buddhist countries where major religious authorities support family planning, many villagers still assume their religion prohibits birth control. In part to overcome this lag in attitudes, family planning programs are increasingly turning to traditional health providers and community leaders for the delivery of rural services and are designing programs to be compatible with specific religious and cultural mores.

Judaism and Christianity

Having led the way in the reform of traditional doctrines on marriage and the family, Jewish and Protestant churches remain more progressive than others in their support for birth control. The break with traditional prohibitions began with the Lambeth Conference of Anglican Bishops in 1930 and by the late 1950s grew to a nearly universal endorsement of all modern contraceptive methods. In recent years Jewish and Protestant denominations have also supported a woman's right to choose abortion. Exceptions to these trends include a few fundamentalist sects, which still oppose abortion, and Orthodox Judaism, which prohibits sterilization although generally allowing abortion.

Christianity

Roman Catholic and Eastern Orthodox
665 million followers; 17% of world population
Protestant and other Christian
324 million followers; 8% of world population

The permissive stand of Jewish and Protestant sects contrasts sharply with the negative stand of the Eastern Orthodox and Roman Catholic hierarchies. Although the latter no longer condemn non-procreative sex (as they did less than 20 years ago), they do still condemn the use of "artificial" methods of birth control. This condemnation, reconfirmed in Pope Paul's 1968 Encyclical *Humanae Vitae*, maintains that "every conjugal act must be open to the transmission of life." Only the rhythm method, which limits intercourse to the nonfertile periods of the menstrual cycle, meets this condition.

Pope Paul's stand—still unchanged—constitutes the major obstacle to full cooperation by the Catholic Church in responsible population programs. Ironically, it also undermines the church's current fight against abortion by limiting access to alternative means of birth control, especially for the poor. But in actual practice the Encyclical has failed to curb a mass defection from Papal authority by educated Catholics everywhere. Encouraged by the liberalism of Pope John and of successive Papal commissions on marriage and the family, many US Catholics began abandoning the rhythm method for more effective means in the early 1960s. Most turned to the pill, initially tested by Catholic doctors Rock and Garcia and promoted as a means of menstrual regulation compatible with Catholic doctrine (in contrast to "barrier" methods like condoms and diaphragms which prevent passage of the sperm). Pope Paul's later disapproval of the pill in 1968 made little difference in the growth of Catholic acceptors. In fact, noted Catholic sociologist Father Andrew Greeley attributes "a drastic decline" in church attendance almost entirely to the Vatican stand on birth control.

Dismay over the 1968 Encyclical also extended to the clergy, many of whom (having fully expected a change in church doctrine) publicly challenged the pronouncement. Throughout Europe and Latin America many local priests now quietly counsel couples to make their own responsible decisions on contraception. The Vatican has muted its

own opposition to nonsurgical methods as its campaign against abortion (and most recently sterilization) has intensified. At present, government family planning programs operate with the tacit or open support of local Catholic bishops in 24 Latin American countries and the Philippines. In fact, in the Western Hemisphere the most conservative bishops are those in the United States.

Islam

In contrast to Christian traditions, Islam has always considered sexual activity for married couples normal and healthy and sexual abstinence an impractical method of regulating births. Thus, while Mohammed called on his followers to "marry with a fruitful woman," he also condoned the widespread practice of *coitus interruptus* to "protect the wife's health and beauty and to allay anxieties over numerous children." Throughout the Moslem world in high-level meetings such as the Rabat Conference and among religious scholars from all four orthodox schools of Islamic law, traditional sanctions have been translated into almost unqualified support for family planning. In the last decade *Kalifas* (official religious pronouncements) favoring family planning have been issued by religious leaders in a dozen Moslem countries, and the great mosque of Al-Azhar, Islam's most prestigious institution, has thrown its full weight behind Egypt's population program. Only a few sparsely populated desert countries are still pronatalist. Most of the larger Moslem countries, including Morocco, Tunisia, Egypt, Turkey, Iran, Pakistan, Bangladesh and Indonesia, have extensive government programs to reduce population growth.

Islam

515 million followers
13% of world population

These programs are, however, hampered by the position of women in Moslem societies. Outside the major cities women are permitted few social or economic roles beyond motherhood. Their seclusion, through Moslem customs like *purdah*, limits acceptance of any family planning method which requires physical examination by a male doctor. The belief that a menstruating woman is unclean and should not prepare food limits the use of IUDs or other methods that produce irregular bleeding. However, sterilization as a one-time medical procedure has gained acceptance in several Moslem countries like Bangladesh, Pakistan and Tunisia, despite the opposition of a few Moslem scholars who contend the present irreversibility of the procedure makes it contrary to Moslem law. Islamic scholars have, for the most part, permitted early abortions under a variety of conditions but consider that abortion is immoral except to save the mother's life once the fetus has "quickened," that is, after the fourth month.

Hinduism and Buddhism

Perhaps because Hinduism and Buddhism have not been crusading religions, their teachings are less pronatalist than those of Islam or Christianity. Buddhism, for example, does not consider procreation a sacred duty and contains no injunction to be fruitful and multiply. In both Thailand and Sri Lanka, Buddhist leaders—generally supportive of family planning—characterize any increase in the human population that

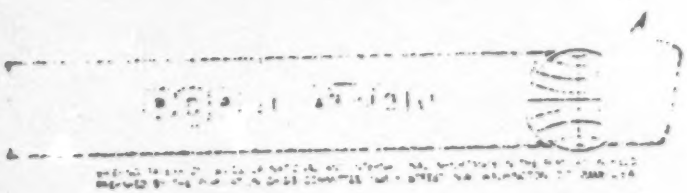
is disproportionate to available resources as "a departure from Buddhism's middle way." In India concern over population growth has led authoritative interpreters of classical Hinduism, like Radhakrishnan, to conclude that all methods of contraception, including sterilization, are permissible and that early abortion, which is now legal, can also be justified.

To Westerners the Eastern religions appear almost contradictory in combining frank sexuality with ritual and philosophical requirements for periodic abstinence. Unlike most other religions, Hinduism and Buddhism also recognize a gap between the ideal and the permissible, applying different standards of behavior to different social classes and distinguishing degrees of seriousness in transgressions of basic commandments. While both religions have a strong bias against abortion, for example, the practice is tacitly approved, particularly among the poor, in the early months of pregnancy, or where any medical indications are present.

Hinduism and Buddhism

740 million followers
19% of world population

As in other religious communities, more education leads to more support for family planning. In recent surveys educated Hindu and Buddhist leaders found no contradiction between traditional teachings and contraception, while the uneducated assumed the two were irreconcilable. At the village level, religious concepts underlie a diverse assortment of folk beliefs and practices occasionally inimical to the principle of planned families, even though no specific prohibitions on contraception exist. Among Hindus one basis for conservatism lies in the principle of *ashimsa* (literally "no harming") which, although mainly used as an injunction against abortion, is interpreted by a few Indians as a bar to all artificial forms of birth control. Likewise, a few Buddhists consider the prevention of pregnancy an interference with *Karma*, the process of reincarnation, and thus a suppression of life. At the policy level, however, these interpretations have minimal impact on government support for family planning. Nearly all Hindu and Buddhist countries now support major efforts in family planning, most of which include voluntary sterilization and in some cases abortion.



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No. 6 January, 1977

Religious Attitudes
Toward Birth Control

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MR T. H. PICKENS
AURORA PUBLIC SCHOOLS
AURORA, CO 80010

POWER SOURCES

CONSERVATION

Description: The reason for the U.S. energy crisis is quite simple: demand for energy is increasing while supplies of oil and natural gas are diminishing. A major cause of that ever-growing demand is our huge stock of capital goods--such as homes, cars, and factory equipment--that use energy inefficiently. This inefficient stock developed during the decades of the 1950s and 1960s when energy was so cheap that no one really thought about using it wisely. But times have changed and so must our patterns of energy use. Fully two-thirds of the energy America now consumes does no actual work. While half that loss is the unavoidable result of physical limits to efficiency, much of the remainder is simple waste.

Energy consumption may be divided into three main groups: Industrial, Transportation, and Residential-Commercial. The use made of energy by each of these groups must be carefully analyzed to identify those areas to be targeted for energy savings. In the industrial area we know that various U.S. industries are substantially less fuel-efficient than their Western European counterparts--and their standard of living is equal to ours. Hence, we can learn from their methods of operation. We know that probably the most significant factor in determining the gasoline mileage of an automobile is weight. We also know that an average new car in Europe weighs about 1,900 pounds while in the U.S. it weighs about 3,300 pounds. We also know that mass transit and rail transport are much more efficient than the private automobile. We know that space heating is the major category of energy consumption in homes and buildings and yet temperatures are maintained at unhealthfully high levels in the winter and air conditioners run far too cold in the summer. Our pricing system also is out of line and fails to penalize waste. In the area of utility pricing, the smallest users commonly pay the highest unit price due to practices such as declining block rates. If we pay yesterday's prices for tomorrow's energy, United States resources will be rapidly exhausted. The pricing of oil and natural gas should reflect the economic fact that the true value of a depleting resource is the cost of replacing it.

Positive Features: Because we are rapidly running out of oil and natural gas, we must switch to the predominate use of other energy sources. However, the changeover from one energy source to another cannot and does not happen overnight. Conservation will help buy the time for making that transition and is also the most effective means of improving our supply-demand problem. It has been pointed out that a barrel of oil saved is as good as a barrel produced--but in many ways it's better. According to cost-effectiveness studies

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by the Federal Government, it costs only a tenth as much to save energy as to produce it. This is significant when one considers that our oil imports now account for almost half of our needs. Wasted energy--in cars, homes, commercial buildings and factories--is greater than the total amount of our oil imports. It is argued that a reduction of America's demand for world oil will be a form of assistance to the developing countries who so desperately need it.

Associated Problems: Conservation goes against the more-is-nicer, bigger-is-better philosophy we have operated with so long. Although conservation measures are inexpensive and clean compared with energy production and use, they do sometimes involve sacrifice and are not always easy to implement. Smaller, lighter, less powerful cars mean a loss in some driving comfort and horsepower, but they don't inhibit our ability to travel. In summary, conservation may cause some inconvenience and require some sacrifice, but that is far better than the projected drastic measures that will have to be taken in the future if we fail to act now.

Estimated Available Energy: The ERDA goal for the year 2000 is to reduce energy demand in buildings by 7.1×10^{15} Btu. This is 4 or 5 percent of the 150×10^{15} Btu or so per year we are expected by some to be using in that year--a not unreasonable goal.

The ERDA goal of energy saving from more efficient use in transportation is 9×10^{15} Btu (9Q) in the year 2000.

COAL

Positive Features: Of all the alternatives to the burning of oil and gas, coal offers the most immediate promise. This is because our needs are large and so are our coal reserves. Coal is the most abundant remaining fossil fuel that we have any real experience with. Most of our electric generating plants are already set up to run on coal, and electricity is a highly desired form of energy. Coal deposits are well mapped out, and we have the equipment to get at them.

Associated Problems: But with all these advantages, the large scale use of coal will cause major problems. Coal is difficult and dangerous to mine underground. Surface mining is both more economical and it's safer. However, water is very scarce in the West where almost all coal is surface (strip) mined. This makes land restoration costly and difficult. Coal is also the most polluting of the fossil fuels. Burning results in the emission of varying quantities of sulfur oxides and particulates. Increasing our use of coal for industrial, commercial, or residential purposes will require large new investments in pollution control equipment unless society is willing to accept dirtier air and more cases of respiratory disease. In addition, there is no satisfactory means of using coal as a fuel for transportation other than the inefficient process of producing electricity to power trains, buses, and cars. Finally the burning of vast quantities of coal will result in an increase in the carbon

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dioxide content of the Earth's atmosphere. The National Energy Plan calls for the expenditure of nearly $3 million to try to determine the long-term effects of this increase.

Estimated Energy Available: The United States has an estimated four trillion tons of coal resources. About one-half trillion tons can be mined economically by current technology. The recovery of these shallower reserves is the main objective for increasing coal production by conventional methods to meet near-term needs and reduce U.S. dependence on foreign energy supplies. The remaining three and one-half trillion tons are either too deep, or in seams too thin, too wet or too mixed with rock to be recovered by conventional mining. Current production of coal is about 600 million tons yearly. One of the goals of the National Energy Plan is to increase coal production to more than 1 billion tons per year by 1985. With a production rate of 1 billion tons per year, one-half trillion tons would last 500 years.

NEW FUELS FROM COAL

Description and Positive Features: About 90% of the nation's fossil fuel reserves are coal; however, most of the nation's consumption (about 76%) involves oil and gas while coal represents only 18% of the total.

To reverse this trend while maintaining high environmental standards, the U.S. could convert some of its vast coal reserves into clean gaseous, liquid and solid fuels suitable for power generation, transportation, residential and industrial uses.

Both coal gasification (conversion of coal to gas) and liquefaction (conversion of coal to liquid and solid fuels) involve high temperature and pressure. Since coal is essentially a form of carbon containing only a small amount of hydrogen, the addition of hydrogen is required to make synthetic hydrocarbons.

Coal can be converted to three types of gas:

1) High-Btu (or high energy) gas which can be directly substituted for natural gas.
2) Medium-Btu (or high energy) gas which can be used for:
   a) utility boilers
   b) industrial fuel
   c) chemical feedstocks
3) Low-Btu gas for electrical generation.

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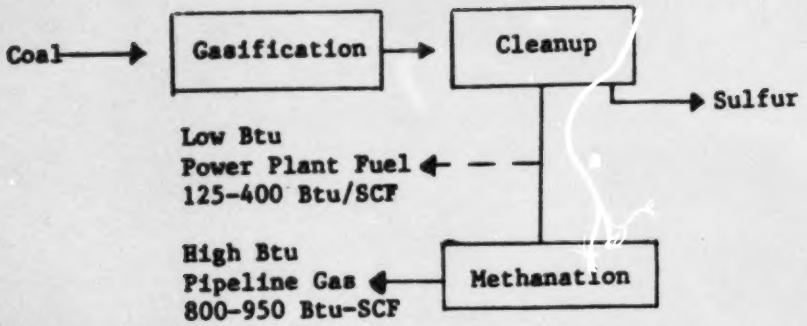

The major steps in the coal gasification processes are shown in the diagram. For high-Btu gas, the three major steps of gasification, cleanup and methanation are involved. The various processes under commercial development differ in method, temperature, pressure and other conditions in accomplishing these three steps. Low-Btu gas can be obtained by eliminating the methanation step and the use of air rather than oxygen in the gasification step. The state-of-the-art in coal liquefaction in the U.S. is not as well developed as that of coal gasification; however, technology should be available by the early 1980s. Coal liquefaction has two advantages over coal gasification:

1) Petroleum substitutes produced from liquefaction can be transported by more means immediately into the wide spectrum of petroleum needs.
2) Gas is produced as a byproduct when producing liquids and solids from coal.

Plants can produce as much as 3 barrels of synthetic liquids per ton of coal processed. The first gasification and liquefaction plants are expected to be in the West or Midwest, near the more accessible and cheaper coal reserves, but some early plants could be on the East coast near Appalachian coal fields.

Associated Problems: Environmental problems have dampened some of the enthusiasm for gasification and liquefaction. Large quantities of water are consumed in both of these processes. As a rule of thumb, about 1.5 to 3 pounds (or about 2 quarts) of water are required for each pound of coal processed. This is about twice the needs of an electric power plant of the same energy output. Since much of the coal to be gasified is located in the semi-arid West, this is a major problem. Also, some water needs disposal, and this water must be treated. Recovery and treatment systems will also be needed to minimize air pollution. Large quantities of solid waste such as sulfur and ash will require disposal. Then, there is the whole net energy question. It takes energy to grind up coal and then change it to oil and gas. Does enough energy remain in the final product to justify the whole process? Finally, a new and different worry for the synthetic fuel industries has recently surfaced. It has been known for some time that at the high temperatures used in these coal

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conversion processes, molecules known as "polycyclin aromatic hydrocarbons," PAH, are formed. There is ample evidence that many of these PAH's are carcinogenic, that is, cancer-causing. This problem has so far not been publicly addressed by the proponents of a coal-based synthetic fuel industry.

Estimate of Energy Available: Obtaining significant amounts of energy from synthetic fuels is years away because of technological problems and the lead times involved in constructing operating commercial plants. The long range goal is to use the process to produce 14 of the 180 or so quadrillion (10^{15}) Btu's of energy we are expected to use in the year 2000.

CONVENTIONAL NUCLEAR REACTORS

Description: The nucleus of an atom is best examined or probed by shooting "bullets" at it. The best bullets for probing the nucleus are neutrons because they have significant speed and mass when they are produced, and because they have no electric charge. Their lack of charge enables them to move toward a nucleus completely unopposed by any electrical effects. What usually happens when a material is bombarded with neutrons is that the bombarded nuclei absorb neutrons, emit alpha, beta, or gamma rays and become different materials. However, when uranium-235, plutonium-239 or uranium-233 are bombarded with neutrons, their nuclei fission (split) into two parts of approximately equal mass. This process releases a huge amount of energy and it is also accompanied by the release of two to three neutrons per fission. Each new neutron can, if properly slowed down by a "moderator," cause another nucleus to split, releasing more energy and still more neutrons. Under certain conditions, a chain reaction is possible in which one neutron produces two which produce four which produce eight, etc. In each fission, huge amounts of energy are released and so a nuclear explosion (a bomb) occurs. If, on the other hand, you control the growth in the number of neutrons (using control rods), you have an energy source that can be used to produce electricity. The heat released in the reaction can be used to boil water or some other liquid. The resulting steam can turn the turbine in a conventional generator.

Positive Features:

1) A significant amount of energy is available to us in the form of nuclear energy.
2) We know how to build and operate ordinary fission reactors. We have been doing this for many years.
3) A significant shift to nuclear energy will reduce our country's dependence on foreign sources of petroleum-based products.
4) Considering that fission-produced electricity is a complicated new technology, our conventional nuclear reactors have operated reliably and, considering the dangerous materials they use, quite safely.

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5) Government studies have concluded that fission power plants have a favorable net energy yield, although some experts maintain that these calculations may not include all of the energy inputs to the system.

Associated Problems:

1) The fission process consumes uranium and thorium-based nuclear fuels. A significant shift to nuclear power would result in our using up our nuclear reserves in a relatively short time (20-50 years). If our uranium-235 reserves are consumed before our breeder program gets off the ground, we theoretically lose the energy stored in 99% of our uranium reserves.
2) The fission process produces longlived radioactive wastes that are a health and environmental hazard. At the present time we don't know how to safely store these wastes, and we have no right to pass them on to our grandchildren.
3) A shift to nuclear energy would initially reduce our dependence on foreign petroleum products, but it would soon result in a new dependence on foreign sources of uranium and thorium.
4) The disposal of heat produced by nuclear reactors is a serious thermal pollution problem. Expensive cooling towers and cooling ponds that dissipate heat out into the atmosphere must be constructed at the reactor site to minimize the environmental impact of such large-scale heat disposal.
5) Safety and the adequacy of future fuel supplies are the subject of an emotional national debate. The debate itself makes the whole future of nuclear power uncertain.

Estimation of Available Energy: It is difficult to estimate the amount of energy available from nuclear sources because the numbers and the projections keep changing and the topic is so controversial. However, whether we like it or not, nuclear energy will play a role in providing for our energy needs for the next decade or two and nuclear reactors could produce as much as 20 percent of our electrical energy by 1985.

Uranium fuel production begins with a search for ore (anything that can be mined for a profit). The raw ore is then milled or concentrated to a product called "yellowcake" which is 80 percent U_3O_8 (uranium oxide). Resource estimates are given in terms of tons of yellowcake and are distinguished by the production cost in dollars per pound. At present we have 420,000 tons of $15 per pound reserves. As of November 1976, 64 conventional nuclear reactors were contributing 45,500 megawatts of generating capacity (8 percent of the nation's electrical power). We can calculate that the 45,500 megawatts of reactors will use up the 420,000 tons of $15 per pound reserves in 73 years. This figure is very small. However, if we base our calculation on the reserves available at $30 per pound or less, the reserves will last much longer. Then there are the potential resources (those not yet discovered and developed). This lengthens the lifetime

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even more provided we don't build any more reactors. However, we will. A fair summary seems to be that uranium supplies are sufficient to fuel the planned reactor program into the next century, but that without new supplies or a new technology (like the breeder reactor) it will provide only temporary relief to our energy shortage.

BREEDER REACTORS

Description: The uranium-235 isotope, which is the fuel in a conventional nuclear reactor, is the rarer of the two main isotopes of uranium. The most common isotope, uranium-238 (99.3% of all our uranium supply), cannot be used to maintain a fission chain reaction. But by allowing the uranium-238 to take up some of the spare neutrons in a reactor, it will eventually be changed into the isotope of another element, plutonium-239. This isotope can be fissioned by neutrons just like uranium-235 and can be used to produce heat in a reactor.

By absorbing neutrons, the common isotope thorium-232 can be changed, in a similar way, to form uranium-233. This isotope can also be used to sustain a neutron-caused chain reaction.

It is beyond the scope of this unit to discuss reactor design, fuel rod fabrication, breeding ratios and spent fuel rod processing. Suffice it to say that by careful selection and arrangement of materials in a reactor, the neutrons not needed in the fission chain reaction can be used to convert U-238 and Th-232 into Pu-239 and U-233. Thus scientists and engineers hope to be able to make use of most of the uranium and thorium in nature for the release of nuclear energy and the production of electric power.

Positive Features:

1) A significant amount of energy is available to us in the form of nuclear energy--especially if the breeder program becomes a reality.
2) A significant shift to nuclear energy will reduce our country's dependence on foreign sources of petroleum-based products.
3) Because breeders make nuclear fuel as they run, they will greatly extend the lifetime of our nuclear fuel reserves. (Note: Thorium is several times more abundant than uranium, but statistics are inexact because even today there is no thorium mining industry.) Without the breeder, we would reach the bottom of our nuclear fuel reserves early in the next century. Breeders can postpone that day for a long time (500-1000 years?).

Associated Problems:

1) Like ordinary fission reactors, breeder reactors produce longlived radioactive wastes that are a health and environmental hazard. At the present time we (the people, the government) haven't agreed on a method to store those wastes.

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2) Like ordinary fission reactors, breeders produce large quantities of "waste" heat--which implies a potential thermal pollution problem.
3) The fissionable materials produced in a breeder should be used to power new breeder reactors. However, since they are fissionable, they can also be used to make nuclear weapons. Clandestine bomb-making and blackmail by radical groups is not out of the question. Trucks hauling spent fuel rods can be hijacked. Any country that has the capability of producing plutonium-239 or uranium-233 also has the capability of becoming a nuclear power--as India demonstrated. The more than occasional success of undertakings by terrorists and other fanatic groups adds to our worries.
4) The plutonium-239 problem: Plutonium-239 is radioactive and an alpha emitter. If inhaled into the lungs, it can cause intensive damage in the tissue and cause cancer. Plutonium has been termed the most dangerous substance known to man. Where plutonium is used, we must not only minimize leakage, we can't permit it at all.

Estimate of Energy Available: ERDA's estimate of the energy available from our nuclear reserves is 130,000 quads, or enough energy, at 1975 levels of consumption, to provide all this country's energy needs for about 1800 years. However, the fears related to the health and safety hazards that may be associated with the use of the breeder led President Carter to call for a reduction in the breeder program, an indefinite postponement of the plutonium processing program and the indefinite postponement of the building of our nation's demonstration breeder power plant. Hence, with all the energy available, it could be that in the year 2000 we will receive no energy from breeder reactors.

SOLAR HEATING AND COOLING

Description: On the average, enough solar energy strikes the roof of most American homes to provide for all or a very significant portion of their total heating needs. This is true throughout the entire year. Basically, an active solar heating system works like this:

1) Collectors are installed, usually on the roof or ground near buildings, to absorb the sun's rays. A collector is usually a black plate covered on the sun side with transparent glass or plastic. An air space exists between the cover and the black plate. Black is used because it is an efficient absorber of sunlight. The transparent covers trap heat in the collector much like glass does in a greenhouse.
2) Water or air is circulated (usually in pipes) through the collectors to absorb captured heat and carry it to a storage tank (usually in the basement).
3) If air is circulated, the heat is stored in hot rocks. If water is circulated, the storage tank is usually a large tank

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of water. Fans or pumps are used to deliver the heat to the various rooms of the house.

A passive solar heating system is one in which there are no storage tanks, fans or pumps. Instead, the home is custom-designed to allow the sun's rays to enter the house through windows in the winter and prevent the sun's rays from entering in the summer. This is usually accomplished by using overhangs or be recessing the windows. If the home is well insulated and if the climate is generally sunny, this concept works very well.

Solar Cooling: At first it sounds impossible to consider using solar energy to cool a house. But the same principle behind the operation of our household refrigerators can be adopted to using the sun for cooling. A refrigerator is a "heat pump." Heat is transferred by exposing an expanded and, therefore cold, gas to the cool interior. This gas then flows to the outside coils where it is compressed so that its temperature increases. The heat is radiated (discharged) into the kitchen. In an electric refrigerator, pumps and compressors are used. In a solar cooling system, solar heat drives a vapor out of a liquid which expands, cools and picks up heat. It is then reabsorbed in the liquid to carry the heat away. The major difficulty with solar cooling units of this type is that temperatures of 200^{o}F or higher are needed. Since flat plate collectors cannot easily produce temperatures higher than 150^{o}F, some kind of concentrator (such as a parabolic mirror) is needed.

Advantages: Solar energy is our most abundant and available source of energy. It is a sustainable resource. It does not pollute the environment or produce dangerous waste products. Solar collectors can be used independently of central electric power generating stations. There are no foreseeable shortages of the basic materials needed for the widespread use of solar heating systems. Solar energy cannot be embargoed.

Disadvantages: The initial costs for putting in a solar heating system are now (1977) very expensive. It is hoped that by 1980 the costs (when spread out over 20 years) will be competitive with other types of heating. Because sunshine is unpredictable, storage must be provided. To keep costs down, the storage is usually only enough for 2 sunless days. After that an auxiliary heating system must be used. This additional heating system adds to the expense.

Estimate of Available Energy: In the South and Southwestern portions of the U.S., enough solar energy falls on the roof of the average home to take care of the total heating requirements during the winter months. Even in the Midwest and New England states, solar energy can provide more than half of the energy needed for winter heating. As conventional fuel costs rise, it will become economical to use solar energy for heating in the North as well as the South.

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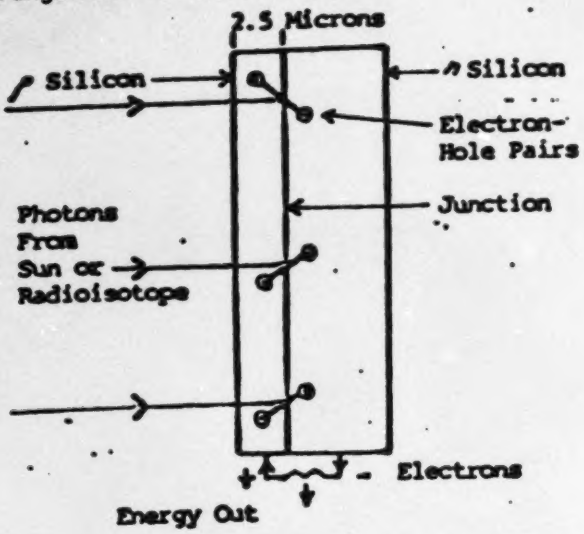
ELECTRICITY FROM THE SUN I
(Solar Photovoltaic Energy)

Description: Solar radiation can be converted directly to electricity in a solar cell. These little devices utilize the "photovoltaic effect." Photons, the little particles which make up a beam of light, if they carry enough energy, can knock electrons loose from the atoms they strike. Solar cells combine this property of light with the unusual properties of a semiconductor. A semiconductor consists of a junction between two dissimilar materials. A typical arrangement is shown below:



The p-region is transparent to light and very thin. Photons of light entering this region release electrons from the silicon atoms. The electrons flow in one direction across the junction and the holes move in the other direction. This sets up a potential difference, a voltage, and if circuity is provided as shown, current will flow, electrons toward the positive terminal and holes in the opposite direction, and electric power will be available.

Positive Features: Solar cells have been used for years to power space vehicles, highway call boxes, offshore buoys and other devices which, because of their isolation are difficult to fuel in any conventional way. Once installed they essentially require no maintenance.

The chief barrier to widespread use of solar cells is cost. However, research breakthroughs and mass production should lower the cost significantly making photovoltaics commercially competitive.

Associated Problems: Solar cell arrangements with large capacity for electric power production can be constructed. 1000 watts or 1 kw is enough power for most household needs. Such an arrangement, however,

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costs approximately $30,000.00 (1977). Even with skyrocketing costs, conventional power plants can produce power at less than $1,000 per kw.

Other than cost, the largest problem associated with the use of solar cells is the large amount of land they take up. One method suggested for eliminating this problem is to build satellite solar power stations in space. Since the satellite could receive sunlight continuously, it would receive about seven times as much solar energy as an Earth-based panel. The electric energy would be converted to microwave radiation and beamed to Earth where it would be collected and reconverted.

Estimated Energy Available: The goals of the most recent National Solar Energy Research Development and Demonstration Program (ERDA-49) are for 100 megawatts of photovoltaic generating capacity by 1985 and 30,000 megawatts by the year 2000. Present U.S. electrical production capacity is about 500,000 megawatts.

ELECTRICITY FROM THE SUN II
(Solar Thermal Energy Conversion)

Description: Solar thermal energy conversion is a collection system that concentrates enough sunlight onto a boiler or a fluid (example--water or heat-conducting oil) to create temperatures high enough in heat quantities sufficient enough to make large quantities of steam. The steam in turn is used to spin a turbine which rotates the coil of a generator which produces electricity. Two methods for doing this are being extensively researched. The first method is called the distributed collector concept. In its most common form, a long reflecting trough with a parabolic cross-section concentrates solar energy onto a collector tube through which flows a heat-conducting oil. In a heat exchanger, the oil transfers its heat to water to produce steam. Excess heat is stored for use at night and while the sun is not shining. The second method seems even more promising because of the higher temperatures achieved. In this concept, a field of computer-guided mirrors track the sun and focus the sun's rays onto a boiler which is mounted on top of a central receiving tower. Here, the radiant solar energy is absorbed and used for the production of steam.

Positive Features: The main advantage, of course, is that sunshine is free. In addition, the environmental impact of these systems is relatively minor.

Associated Problems: Only direct sunlight is usable, thus restricting solar thermal power plants primarily to the sunny areas of the country. There are no basic technical limitations in this method. The main questions are overall efficiency and economics. One key consideration is space. Sunlight is diffuse and must be collected over a wide area.

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It is estimated that in the Southwestern part of the U.S., approximately 26 kilometers (10 square miles) would be needed to operate a 1000 megawatt plant working at an average capacity of 60%. This is enough power to supply a city of 1 million people. At present, there is no economically attractive method for storing heat for use at night and while the sun isn't shining.

Estimate of Available Energy: By the year 2000, some 20,000 megawatts of solar thermal generating capacity has been estimated. This is about 4% of the present electrical generating capacity of the United States.

SOLAR SEA POWER
(Ocean Thermal Energy Conversion)

Description: The biggest collector of solar energy on earth is the oceans. This fact makes possible the whole concept of ocean thermal energy conversion. Ocean thermal energy conversion uses temperature differences between surface waters and ocean depths to generate electricity. Basically, this is how ocean thermal conversion works:

1) The ocean's top layer, heated by sunlight, is relatively warm ($80^{o}F$). The lower layers (1,500 - 4,000 feet down), untouched by the sun, are cold ($40^{o}F$). A sea power plant in the ocean would draw warm water from the surface to heat a working fluid such as ammonia, propane or freon until it evaporates.
2) Pressure produced by confining the steam to a small container can rotate a turbine and thus power a generator. Cold water drawn from the depths cools the working fluid until it condenses back into a liquid and the entire cycle is repeated.

All this takes place at a power plant situated on a large floating platform. Electricity can either be sent to land through cables for conventional uses or be used to extract hydrogen from sea water. Hydrogen can be used in many ways to replace fossil fuels. Electricity could also be used to combine nitrogen from the air and hydrogen from the water to make ammonia, the primary ingredient for fertilizer.

Positive Features: Since mechanical energy can be extracted from the flow of heat energy between a hot and a cooler region, the temperature differential that exists between deep and shallow ocean water represents a constant and considerable source of energy.

Associated Problems: This process is still highly speculative. The potential for capturing this power is largely unproven because little experimentation has been done. Questions that need to be answered include: Can a design and materials be found that will resist the corrosive power of sea water? What impact on aquatic life or ocean cycles would the mixing of warm and cold water produce? Is a net energy yield possible? What are the legal and jurisdictional

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considerations associated with the operation of floating ocean thermal power plants? Finally, the cold water contains large amounts of dissolved carbon dioxide which would be released upon warming. What might be the long-term environmental effects of this?

Estimate of Available Energy: An ocean thermal energy demonstration plant could contribute 100 megawatts of electrical generating capacity by 1985. It is estimated that ocean thermal energy conversion could produce 20,000 megawatts or more by the year 2000. Present U.S. electrical production capacity is almost 500,000 megawatts.

CONTROLLED NUCLEAR FUSION

Description: Nuclear fusion is the process by which the sun and other stars generate their energy. It involves joining together the nuclei of two atoms, resulting in the release of energy. Normally nuclei repel each other. This is because all nuclei are positively charged, and like charges repel. However, if the nuclei can be brought very close to each other, the attractive nuclear force becomes stronger than the repelling electrical force and fusion takes place. To get the nuclei close enough, the fuel for the fusion process, heavy hydrogen, must be heated to about 100 million degrees (Celsius, Fahrenheit or Kelvin). At this temperature, the nuclei are moving fast enough so that when they move together fusing conditions are met. The heated nuclei, called a plasma, are confined in a strong magnetic field often referred to as a magnetic bottle. Another method of accomplishing fusion is to embed some heavy hydrogen (deuterium) inside a small glass pellet. If the pellet is zapped with a series of powerful laser beams, the outside layer evaporates almost instantly. The counterforce generated by the rapid expansion of the outer material drives the remaining portion inward. As the material is driven inward, it is forced into a smaller volume and is heated by compression. At the high densities and temperatures generated, the fuel will fuse.

Positive Features: Fusion power has a number of significant advantages over presently contemplated energy sources. These include abundant, inexpensive fuel in the form of heavy hydrogen. Because of its normal presence in all water, it is available to all countries. Fusion features lack of chemical combustion releases that contribute to air pollution and no threat of diversion of weapon materials. There is also no possibility of nuclear explosion, nuclear runaway or reactor core cooling problems.

Associated Problems: The major problem in assessing the impact of fusion is that no one knows for sure whether or not it can be accomplished regularly under controlled conditions in laboratories and power plants.

Environmental problems associated with fusion power are expected to be few. Small quantities of radioactive tritium will be released

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by fusion power plants. The structure inside the fusion chamber will become radioactive as a result of being bombarded by neutrons from the fusion reaction. This radioactivity will be relatively short-lived so that the structure can be refabricated for later use. The effect of high energy neutrons on metals and other materials is not well understood, and materials research is vital. It may be that the identification and development of materials for the inner chamber walls and other components of the fusion reactor will be the largest technological hurdle faced by fusion scientists.

Estimated Available Energy: It is unlikely that any energy will be commercially available from fusion by the year 2000. Even if a breakthrough occurs, it will take years to move from the demonstration of feasibility to the reality of large-scale power production. However, current research timelines project the availability of some fusion power by the year 2000.

GEOTHERMAL ENERGY

Description: Geothermal energy, the natural heat of the Earth, promises to be an important source of supplemental power in selected areas around the world. While most of the Earth's heat is too diffuse to be recovered, there are concentrated pockets of heat ("hot spots") within the Earth's crust that are accessible and that could provide a significant contribution to local energy needs. If the rocks in the "hot spots" are fissured or porous and contain water, geothermal potential exists. While some of this water and steam bursts through the surface in the form of geysers or hot springs, large deposits often remain trapped below the surface and can be tapped only by drilling wells down into the porous rock. If the source that is tapped is a mixture of hot water and steam it must be piped into a power plant where the water is removed and the steam used to spin the blades in a turbine which drives a generator that produces electricity.

Positive Features: One of the strongest arguments for the increased exploitation of geothermal power is that there are few environmental problems associated with it. Geothermal power plants do not emit products of combustion that can contribute to smog. The use of geothermal energy can help stretch out our supply of oil and natural gas.

In addition to the production of electricity, it is very likely that geothermal energy will make a significant contribution to home and industrial heating. This will occur in the West and Southwest portions of the United States as the needed technology is developed.

Associated Problems: The most serious potential problem is that boron and other chemicals (which are mixed in with the geothermal water and steam) can cause damage if they are released into nearby

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waters or allowed to escape into the atmosphere. There is also the possibility of land subsidence resulting from the withdrawal of large amounts of water, but this could be controlled by re-injecting water into the wells. Less significant problems have to do with the odor of hydrogen sulfide (rotten egg smell) which is released during exploration and the considerable noise involved when the wells are being vented. The chemicals in the water also cause corrosion in pipes and associated equipment.

Estimated Available Energy: The more optimistic predictions concerning the energy available in the U.S. from geothermal sources amount to less than 1 percent of the total electrical generation expected by the year 2000.

WIND POWER

Description: Wind energy conversion is one of the oldest energy systems having been used for grinding grain, pumping water and producing small amounts of electricity. Today, serious research is being done on both horizontal and vertical axis wind turbines. One of the more promising vertical axis turbines, called the Darrieus rotor, resembles the lower section of an eggbeater. It has curved airfoil blades so positioned that it can accept wind from any direction. One of ERDA's goals is to establish a broad technology base from which the public can select a wind unit appropriate for particular needs.

Positive Features: Wind power is cheap and non-polluting. It has features which are well adapted to farm and remote site use--eliminating the need for long and expensive transmission lines. Research continues in the effort to design larger megawatt systems for our nation's wind belt regions. The eventual large scale use of wind turbines for commercial electric power production is expected to occur through the clustering of several units into a wind energy network. The relative low environmental impact, compared to fossil and nuclear plants, has made wind power popular with environmental spokesmen.

Associated Problems: From a technological viewpoint, the major problem is the variable nature of wind energy. Wind power generators operate at their rated capacity only when the wind is blowing at or above some minimum speed. But wind speed is variable. Wind variability also has an effect on rotor revolutions per minute, which in turn influences the output frequency of the generator. Since standard U.S. power networks require constant frequency (60 cycles per second) and Alternating Current (AC), some means for regulating the frequency is needed. The storage problem must also be solved. What do you do when the wind stops blowing? Another drawback to largescale wind power development is land use. Although a single machine does not occupy much space, a giant grid of them complete with power lines would have aesthetic drawbacks. However,

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wind harvesting should be compatible with other uses of the land such as pasturage and farming.

Estimated Available Energy: A 1973 NSF/NASA solar panel study estimates that an annual output of 5.1×10^{15} Btu's of wind energy would be possible by the year 2000. That amount is close to the total electrical demand in the U.S. for the year 1970 and would represent about 5 to 10 percent of our total energy needs in the year 2000.

FUELS FROM PLANTS--BIOCONVERSION

Description: Stored chemical energy, created in plants by photosynthesis, may be a promising supplemental fuel in our energy future. During photosynthesis (putting together with light) in plants, light energy is captured and used to convert water and carbon dioxide into oxygen and energy-rich plant material (carbohydrates). This energy is released when the plants or their products decay or are burned. Current efforts are directed at controlling and boosting natural photosynthesis so that crops can be produced which synthesize carbon compounds with high efficiency and produce fuels in a matter of days. The energy content of biomass is about half that of the better coals. A variety of land and water crops which might be easily and economically grown for harvesting and burning as fuel material are presently under investigation.

Positive Features: The relative abundance of arable land in the U.S., the easy convertibility of biomass into desirable liquid and gaseous fuels, and the low environmental impact of either the production or combustion of these fuels (organic materials are generally low in sulfur, for instance) have all served to stimulate interest in growing plants for energy.

Associated Problems: The strongest argument against the "plants for energy" idea is based on competition for the land. With the growing food shortages, land that can meet the nutrient and water requirements for energy farming might be better utilized for food crops. Biomass cultivation also suffers in a direct comparison with, for instance, solar collection schemes using solar cells or thermal collectors where efficiencies of 10 to 20 percent could be attained instead of the 1 to 3 percent photosynthetic efficiency. In the spirit of "if you can't beat them, join them," the biomass enthusiasts point out that these schemes are not mutually exclusive. Land can produce food and leftover biomass. The rubber producing guayule may grow under and around the rows of solar collectors.

Estimated Available Energy: The ERDA projection is for about 10 Q Btu of energy from biomass sources (other than waste recovery) by the year 2000--5 to 6 percent of the total projected energy use that year.

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FUELS FROM WASTES

Description: It has been said that the wastes of society are simply resources for which we have not as yet found a use. In this view, refuse from human activities can provide a useful source of energy while simultaneously reducing some waste disposal problems. Organic material can produce methane, the main component of natural gas. In the absence of oxygen this occurs naturally, as microorganisms break down the material. Processes have been developed which release synthetic oil or gas from organic wastes and at the same time reclaim valuable minerals from inorganic refuse. Other processes simply allow for the burning of garbage as a supplementary fuel for power plants.

Positive Feature: The conversion of waste to energy significantly reduces the seriousness of the disposal problem so many of our metropolitan areas are facing.

Associated Problems: It is difficult to separate out the various components of typical trash. The paper, the glass, the garbage and the metals are all randomly mixed together. The plants which convert trash to energy need pollution control devices, but generally their contribution to the sulfur oxide pollution in our atmosphere is lower than the fossil fuels. The energy content of trash is typically low and unpredictable. Finally, one must remember that trash, the raw material, is waste. While conversion can reclaim some of the energy, greater gains can be achieved by avoiding the creation of waste in the first place.

Estimate of Energy Available: If all of the trash that Americans throw away had been converted to energy in 1971, that energy would have satisfied 13% of the total energy demand and 44% of the total electrical demand. The amount that can be economically converted is considerably smaller, however, and would provide only 1 to 3 percent of our total energy demands.

OIL SHALE

Description: Oil shale is a sedimentary rock (marlstone) containing solid organic matter of high molecular weight called kerogen. When heated (retorted), the kerogen breaks down yielding substantial amounts of synthetic crude oil and hydrocarbon gas. The world's biggest reserves are found in the Green River formation which is located in the Rocky Mountain region of the western United States. One ton of oil shale may yield as much as 140 gallons of oil. To be of commercial interest, the yield must be approximately 25 gallons per ton or more.

Positive Features: The primary advantage of oil shale is that it is a fossil fuel. The synthetic crude that results from the heating

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of the shale can be refined and changed into all the products we now obtain from the refining of ordinary crude oil. Hence, no new major adjustments have to be made to use the products of oil shale development. Our present automobiles, trucks, furnaces and motors don't have to be modified. The byproducts include the raw materials for the petrochemical industry.

Associated Problems: The problems associated with oil shale development are many and large. The most talked of method for developing shale consists of digging it out of the mountain (room-and-pillar mining), crushing it, heating it, disposing of the large quantities of wastes in small canyons. The environmental impact includes major disruption to the land, air pollution at the refiner, the building of new towns in now remote areas and the consumption of large amounts of water in the waste disposal process.

One of the debates concerning oil shale development centers around the net energy question. Do you receive enough energy from the syncrude to justify the large energy expenditure that went into getting it? Many of the problems related to oil shale development can be minimized if the shale is heated (retorted) underground (in situ). This is accomplished by drilling, fracturing the shale and then retorting the shale underground. The syncrude collects in a depression called the sump and is then pumped out. This method essentially eliminates the huge waste disposal problem and thus most of the problem of water consumption in a water poor area. Unfortunately, much research is necessary to perfect the in situ technique.

Estimated Available Energy: Unless the federal government makes a totally unforeseen commitment, it is estimated that the maximum limit to which an oil shale industry can develop is about 1.5 million barrels per day of production. Since the projected total energy demand for the U.S. in the year 2000 is about 160 Quads per year, oil shale is capable of supplying only about 2% of the need.

TAR SANDS

Description: Tar sands are deposits of rock or sediment containing a heavy oil or tar-like fossil fuel substance too thick to be pumped to the surface by drilling. Tar sands are simply very old oil deposits from which the light hydrocarbons have escaped, leaving the heavy, asphaltic residue behind. The technology for treating tar sands to make synthetic crude oil is relatively simple, although more research on improving the technique is needed.

Positive Features: Since tar sands are hydrocarbon deposits, the raw material can be changed to a whole range of fuels--from gases to heavy furnace oils and solids. These are the fuels that our present economy runs on.

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Associated Problems: Surface mining is the usual extraction method. This procedure has most of the negative impacts on the land and water of the area as coal surface mining. Waste sand left over from the processing stage must be transported back to the mining site or disposed of in some other fashion. Many of the deposits are so deep that even conventional deep mining would be too expensive. Most important, after all of the processing and transporting steps, it is not clear whether a net energy yield can be achieved even for the high grade ore.

Estimate of Energy Available: The largest known tar sands deposit in the world, and the only one that will be of commercial importance in the next decade, is in the Athabasca region of Alberta in western Canada. Estimates of reserves there range from more than 6 billion barrels of easily recoverable, high grade material, to about 300 billion barrels in total potential. Much of the tar sand can be surface mined; however, techniques for in situ (below the surface but without mining) recovery will have to be perfected to extract deep-lying deposits. In the United States, significant deposits have been discovered in Kentucky, New Mexico, Texas, and Utah. Total reserves in the U.S. are estimated to be an equivalent of 30 billion barrels (Energy Alternatives: A Comparative Analysis, Council on Environmental Quality). The Energy Research and Development Administration has made only a slight commitment to tar sands.

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